THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CVII. No. 2416.] LONDON, AUGUST 31, 1909. [61ST YEAR. PRICE 6d.

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OXIDE PAINTS, OILS, AND GENERAL STORES, FOR GAS AND WATER WORKS.

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For Purifier Blow-off Valves.

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For Hard Usage.

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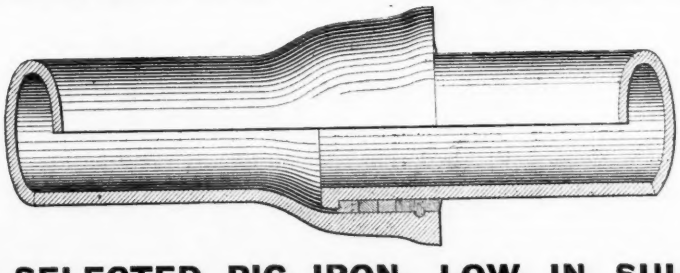
Sockets, Weights, and Thicknesses varied to Engineers' Specifications.

MADE IN DIAMETERS 2 TO 80 INCHES. 8 TO 10,000 TONS IN STOCK.



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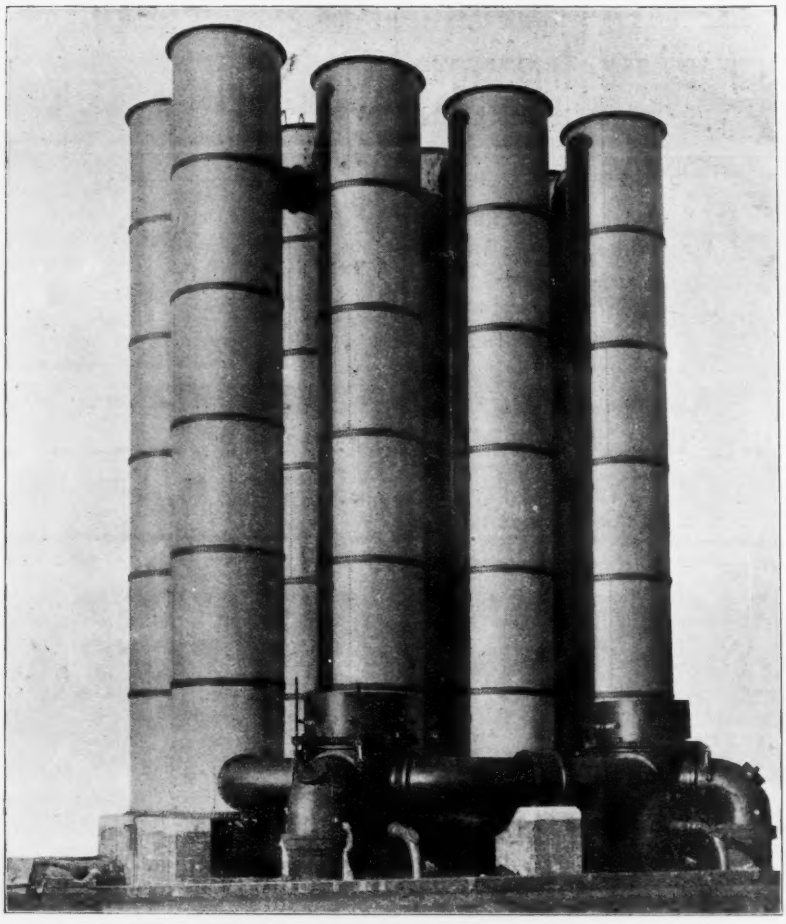
With and without Recovery of the Bye-Products, Tar and Benzol Distilleries, Ammonia Works, and Cyanogen Extraction Plants.



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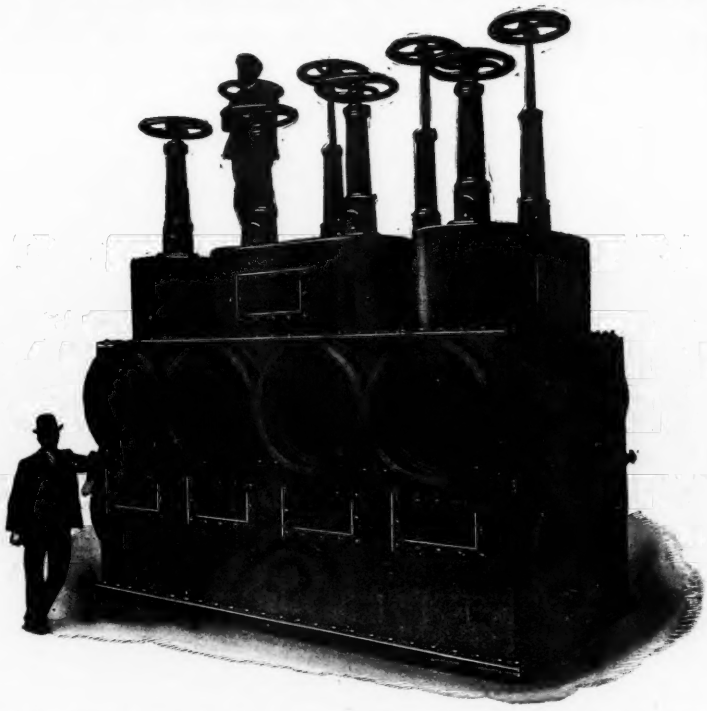

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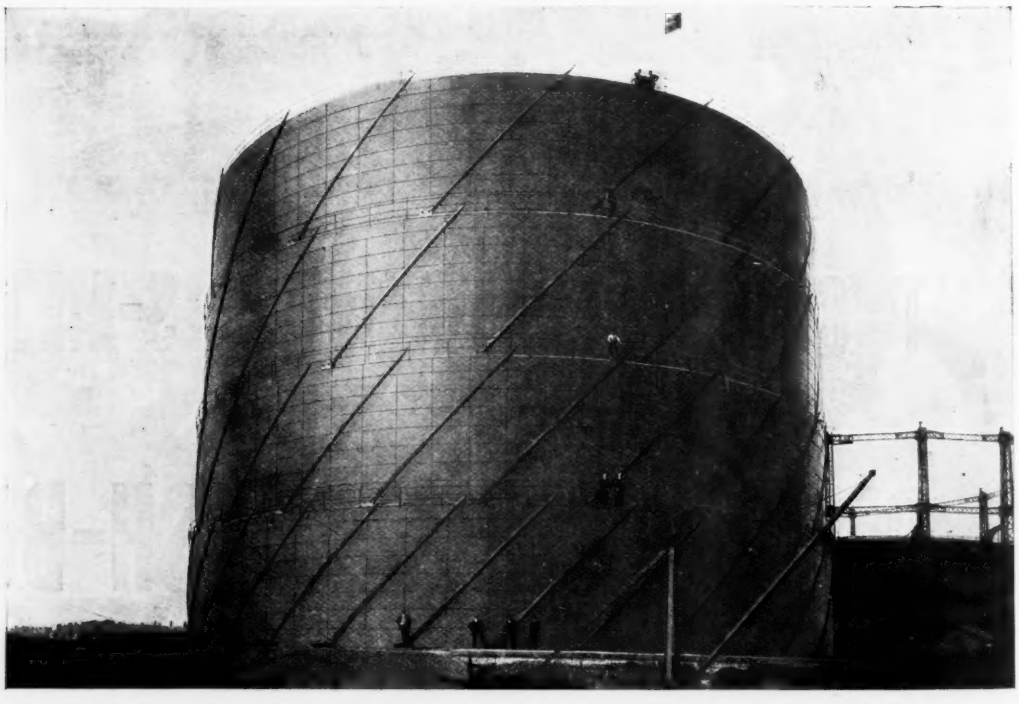

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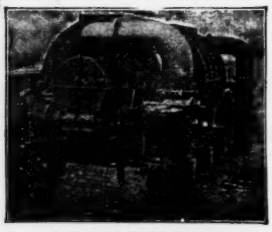
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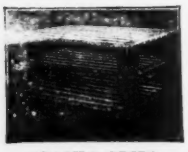
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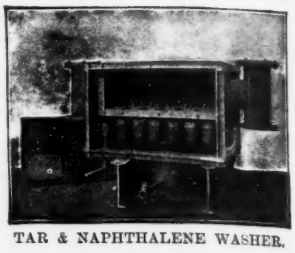
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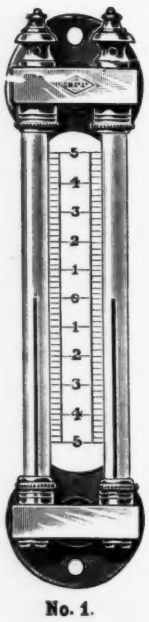
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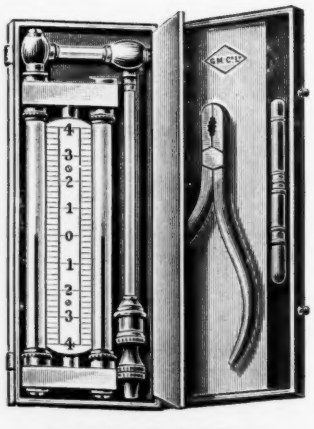
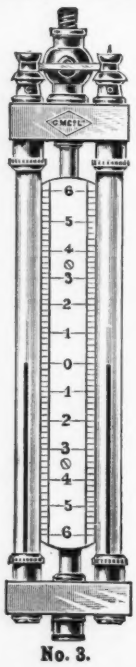

Inspector's Pocket Gauge.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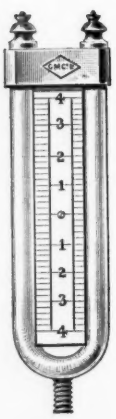
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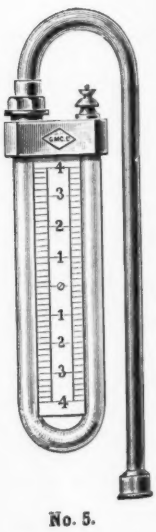
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OUR DISCOUNT SYSTEM GAINS GROUND DAY BY DAY.

Greatly increases Sale of Gas.

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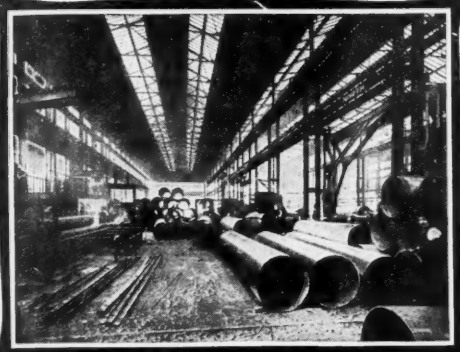
LIMITED
Pepper Rd. Branch, Hunslet, Leeds.



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Horizontal or Inclined; also Makers of Segmental Retorts of all Sections.

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FOR
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1 to 4 lights.

40 to 45 C.P. per cubic foot of Gas at ordinary pressures.

Separate taps to each burner if required.

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Can be used without inner glasses if required.

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Allenstein, Germany	200,000	Frankenthal, Germany	175,000	Posen (2nd)	700,000
Antwerp, Belgium	1,500,000	G. L. & C. Co. Beckton	2,250,000	Prague, Austria	140,000
Antwerp (2nd)	1,000,000	G. L. & C. Co., ,, (2nd)	10,750,000	Preston	1,400,000
Ashford	250,000	G. L. & C. Co., Bromley	3,750,000	Reading	1,000,000
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Barrow	300,000	Gablonz, Austria	140,000	Reichenberg (2nd)	200,000
Bath	1,000,000	Gelsenkirchen, Westphalia	175,000	Revel, Russia	350000
Belfast	1,700,000	Gelsenkirchen (2nd)	350,000	Rhymney Valley	175,000
Belfast (2nd)	4,500,000	Geneva, Switz.	500,000	Romford	300,000
Benrath, Germany	125,000	Gosport	200,000	Romford (2nd)	350,000
Berlin—Charlottenburg	2,500,000	Göteborg, Sweden	300,000	Rotterdam, Holland	850,000
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Birmingham	1,500,000	Hamburg, Germany	1,750,000	St. Gallen, Switz.	225,000
Bishop's Stortford	200,000	Hampton Court	500,000	St. Gallen (2nd)	225,000
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Bognor	100,000	Hartlepool	750,000	San Paulo, Brazil	700,000
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Bournemouth	1,000,000	Heidelberg, Germany	200,000	Scarborough	800,000
Bournemouth (2nd)	500,000	Holyoke, Mass.	600,000	Schwelm, Westphalia	100,000
Bremen, Germany	550,000	Hong Kong	450,000	Shanghai	225,000
Bremen (2nd)	950,000	Hull	1,500,000	Shanghai (2nd)	225,000
Bremen (3rd)	850,000	Ilford	650,000	Shanghai (3rd)	1,600,000
Brentford	1,200,000	Innsbruck, Austria	200,000	Southampton	800,000
Brentford (2nd)	850,000	Ipswich	750,000	Southampton (2nd)	500,000
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Brighton (2nd)	1,850,000	Lawrence, Mass.	400,000	Stafford	500,000
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Brussels—Ville	750,000	Lemberg (2nd)	500,000	Swansea (2nd)	1,000,000
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Brussels—Ville (3rd)	1,500,000	Liége (2nd)	750,000	Swindon	300,000
Brussels—Ville (4th)	350,000	Lincoln	500,000	Sydney—Harbour	500,000
Bucarest, Roumania	1,100,000	Liverpool	3,500,000	Sydney—Harbour (2nd)	500,000
Budapest, Hungary	50,000	Liverpool (2nd)	4,500,000	Sydney—Mortlake	500,000
Budapest (2nd)	1,750,000	Longton	600,000	Sydney—Mortlake (2nd)	500,000
Carlisle	600,000	Louvain, Belgium	800,000	Syracuse, N.Y.	850,000
Carlsruhe, Germany	500,000	Lübeck, Germany	400,000	Taunton	225,000
Chigwell	350,000	Maastricht, Holland	200,000	Taunton (2nd)	350,000
Chorley	300,000	Magdeburg, Germany	1,400,000	The Hague Holland	1,000,000
Commercial, London	850,000	Maidenhead	225,000	The Hague (2nd)	500,000
Commercial (2nd)	850,000	Maidenhead (2nd)	225,000	Tilburg, Holland	400,000
Commercial (3rd)	1,250,000	Maidstone	500,000	Torquay	350,000
Commercial (4th)	2,000,000	Malines, Belgium	500,000	Tottenham	750,000
Copenhagen	700,000	Malmö, Sweden	350,000	Tottenham (2nd)	750,000
Copenhagen (2nd)	2,500,000	Malta	400,000	Tottenham (3rd)	350,000
Courtrai, Belgium	250,000	Manchester	3,500,000	Tottenham (4th)	1,000,000
Coventry	600,000	Manchester (2nd)	3,500,000	Tottenham (5th)	1,000,000
Coventry (2nd)	600,000	Marlborough	100,000	Tottenham (6th)	1,250,000
Cracow, Galicia	200,000	Mayence, Germany	700,000	Tunbridge Wells	1,000,000
Cracow (2nd)	200,000	McKeesport, Pa.	500,000	Utrecht, Holland	1,000,000
Crefeld, Germany	500,000	Merthyr Tydfil	300,000	Utrecht (2nd)	1,000,000
Croydon	1,250,000	Middlesbrough	1,250,000	Verviers, Belgium	1,000,000
Croydon (2nd)	625,000	Namur, Belgium	175,000	Vienna	3,500,000
Croydon (3rd)	625,000	Nelson	400,000	Vienna (2nd)	2,500,000
Croydon (4th)	550,000	Newburgh, N.Y.	600,000	Waltham	400,000
Debreczin, Hungary	100,000	New York	5,200,000	Wandsworth & Putney	1,800,000
Deventer, Holland	150,000	Nictheroy, Brazil	250,000	Watford	300,000
Deventer (2nd)	200,000	North Middlesex	150,000	Watford (2nd)	350,000
Dorking	150,000	North Middlesex (2nd)	200,000	Wellington, N.Z.	350,000
Dublin	2,000,000	North Middlesex (3rd)	75,000	West Bromwich	550,000
Dublin (2nd)	2,000,000	Norwich	1,000,000	West Ham	1,500,000
Dublin (3rd)	650,000	Norwich (2nd)	300,000	West Ham (2nd)	800,000
Dundee	1,500,000	Norwich (3rd)	500,000	Weston-super-Mare	350,000
Dunedin, N.Z.	150,000	Nottingham	1,000,000	Weston (2nd)	350,000
Dunedin, N.Z. (2nd)	275,000	Nuneaton	125,000	Wexford, Ireland	100,000
Durham	200,000	Oberhausen, Germany	175,000	Wiesbaden, Germany	850,000
Düsseldorf, Germany	1,000,000	Oldenburg, Germany	200,000	Winchester	225,000
Eastbourne	1,250,000	Ostend, Belgium	100,000	Winchester (2nd)	125,000
Edinburgh	2,000,000	Ostend (2nd)	200,000	Wolverhampton	1,500,000
Epsom	225,000	Perth, W.A.	125,000	Zwolle, Holland	200,000
Epsom (2nd)	300,000	Poole	1,500,000	Zwolle (2nd)	200,000
Falmouth	150,000				

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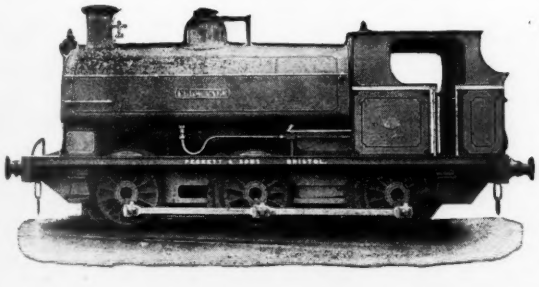

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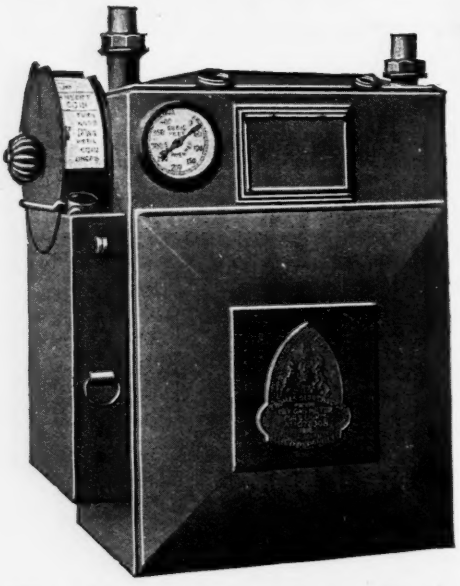

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EDITORIAL NOTES—GAS, &c.

Points from the Session's Work.

THE session of Parliament which is being stretched to such inordinate length in the hope, if the House of Lords is favourable, of getting through the Finance Bill and a few other measures, has not been a particularly happy one. On the side of public business, there has been far too much to do; and, owing to the revolutionary character of the financial plans of the Government, very little solid work has been accomplished. On the side of private business, the concatenation of lean years has remained unbroken; and the quantity of work in the Committee rooms has been at low-water mark. From the economic standpoint, the latter is not a condition to be much regretted; but a sequence of lean years such as there has been in private promotions does not tell a tale of fulgent industrial conditions, and that is a source of keen concern. That the work in the Committee rooms has not been of the magnitude commonly experienced some few years ago, may be taken to be due partly to this lessened amount of promotion, and partly to the growing good sense of those directing the interests involved in the schemes submitted for parliamentary authorization, and which growth in good sense enables them to come to understandings that are of mutual benefit and service in preventing an undue waste of money in contests at Westminster. There is unquestionably, too, a greater confidence in the parliamentary authorities to whom Private Bills are referred. There have been many indications within quite recent years of an intention, though Bills are unopposed, not to allow promoters to exceed precedent and fair requirement without proof of necessity or utility. Nevertheless, in certain respects the authorities have not been oblivious of the fact that the mutations of time make legislative change imperative; and though they are slow-moving and tardy at times, and those interested are correspondingly impatient, in the result that which is required is realized.

This has been seen in the past session in at least three respects. For long, there has been a well-sustained attack on the outstanding inducement to municipal trading—that is, not good service, but profit-making to, according to subtle fallacy, "aid the rates," and (although not freely admitted) indulge the fancy for prodigality on the part of certain town councillors at other people's expense. The latter is an expanding evil with the growth of democratic and communistic doctrines, and with the pandering, frequently unwisely, to class gratification by those who get into power by sowing the seeds of discontent. Not all—thankfully we say it—municipal councillors are of this type; but the growth in power of the wreckers of wise local government most unfortunately means the displacement of those who are actuated by personal or class motives. That in the branch of municipal trading concerned in gas production and distribution, there has been good service, has been, firstly, due to the good fortune of the undertakings in being largely kept so long out of the hands of the types of councillors who sink politic administration to advantage their own ends, and, secondly, to the loyalty of the technical officials to the interests entrusted to their care. But against the increasing ascendency of profit-making in municipal trading, there has been, as we were saying, well-directed attack; and reward has come at last, in the manifestation of a parliamentary intention to right this particular wrong, and to set a limit to the extraction of profits from gas consumers to apply to purposes that should legitimately be borne, in proper share, by every class of the community. There are great and unanswerable reasons why more than ever before this should be insisted upon to-day. One is the preponderance, numerally, of the poorer class of householder in gas consumption; and another the fact that the competitors of gas are not taxed in the same manner—municipal electricity supply contributes but sparingly to the rates; and oil and coal, not being under municipal control, contribute nothing in any similar manner. Those of our readers who are not directly concerned, technically or administratively, in gas manufacture and distribution, will understand this reference to coal better when it is mentioned, that gas undertakings to-day, including many in purely residential areas, send out something like 50 per cent. of their production in the hours of daylight.

However, municipal profit-sharing renders the incidence of taxation, inequitable; and the trend of things was towards enlargement of the inequality. Parliament has intervened, and not too soon. In the House of Lords in the case of the Salford Bill, and in the House of Commons in the Oldham Bill, definition was given this session to the amount of gas profits that could be appropriated, and both authorities were instructed to in future make public lighting a charge upon the common funds, and not in any part upon the gas undertakings, and through the undertakings upon their patrons. Municipal composure, and municipal belief in the sanctity of their ways in this regard, were sadly ruffled; so much so that—the House of Commons authorities being as obdurate as the House of Lords in declining to allow the withdrawal of the gas section of the Bill—the Salford Corporation threw overboard the whole measure, as well as the expense incurred by themselves and by the opposition, for the one purpose of preserving their "full pound of flesh" from the gas profits. The Oldham Corporation took their limitations in a more philosophic spirit. Salford are proposing to promote their Bill again next year, *minus* the gas section; and there is rumour that the outside authorities within the district of gas supply have in contemplation the promotion of a Bill to give legislative effect to the decision of the House of Lords this session. If they persist in this intention, it will open up a source of more than local interest; and we shall be among those who will wish them success. Meanwhile, the Salford Corporation are in humiliated spirit.

In another matter, a change has come over the legislative scene. For some years now attempts have been made to obtain, both through Gas Bills and by advocacy in these columns, protection for gas undertakings in relation to stand-by supplies. Perseverance has been rewarded by the creation of precedent this session. It was an anomalous condition of things that gave legislative protection in this matter to electricity, and refused it in the case of town's gas. There was no reply on the part of the parliamentary authorities to the charge of inconsistency; and at length they have yielded to justice. In both the Heywood and Mountain Ash Bills, protection and rights have been given to the gas undertakings—in the former instance not only in respect of private gas plants, but in cases where gas is made to serve as a stand-by to electricity. Promoters of gas measures in the coming session will do well to read the report in our columns of what transpired in Committee in connection with the successful plea for protection of the Heywood Gas Department. The necessity for protection may not have been felt by some gas undertakings; but those in industrial districts never know when the possession of such powers may be useful—especially if, through stand-by service, they encounter the spasmodic big demands that the Heywood undertaking has of late years experienced. The possession of such protective powers does not compel their exercise.

A third matter, in which the parliamentary authorities have taken a more lenient view than before, has been in the supplementary power granted to make extra charges, within specified limits, in the case of unprofitable prepayment consumers. There is not the material for such a strong case to be constructed out of this, as there is in the matter of stand-by

supplies; for the simple reason that there are well-founded objections to the complication of the prepayment system, having in view the class of consumers affected. Here again circumstances alter cases, and lessen or strengthen the usefulness and necessity for such powers. In the Bury, Heywood, and Mountain Ash Bills of this session, clauses that enable the gas suppliers of the towns to protect themselves and their profit-producing prepayment consumers have been allowed.

These are points in which the authorities of the Houses of Parliament have performed a right-about-face evolution during the session. They are changes all more or less desirable, and having their justification centred in altered circumstance. With them, the further review of the work of the session may be postponed for a week.

From Peak to Peak.

To those whose mental calibre and interests permit them to find delight in treading the paths of the higher scientific realms, the address of the President of the British Association (Sir J. J. Thomson) last Wednesday, in far-off Winnipeg, will be a source of great pleasure; but, in the main, the subject of the address is not such as comes within the purview of the "JOURNAL." The structure of matter and of electricity, the energies of the universe, the ether of space, and radio-activity, were of the principal themes of the address; and these are all subjects that have merely a bordering interest upon the topics which affect the industrial work of our readers. Treating of them, determinate knowledge is found in the address; and upon that knowledge, the President places hypotheses and from it visions potentialities. Considerable progress has been made in the arduous task of discovering what is the structure of electricity; and further knowledge is being actively searched for which will, it is hoped, give the material for constructing what may be called the molecular theory of electricity, and this would be a starting-point for a theory of the structure of matter. We are completely in the hands of the scientists and physicists in advancing our knowledge of such things. It is they who must track the course of development; and the workers in more material matters must devise the practical ways and means of giving mankind the benefit of the fruits of their profound and enlightening research.

There is the lavish supply of the energy of the sun; and the man of commonplace intelligence will probably regard as fantastic the vision of a greater share of that energy being brought under control by our engineers, and applied to the service of man. Already the world's work is done by the energy stored in coal, in waterfalls, and in food. But this gift of Nature is not treated, the President thinks, with sufficient consideration. Her lavishness in this regard, leads to lavish waste on the part of mankind. But whence are to come the means by which economy is to be obtained through conservation and application? It is computed that the heat received under a high sun and a clear sky is equivalent to about 7000-horse power per acre of land. How much of this is doing work for present and future generations, and how much is being wasted, no one can tell. But the erudite President has "not the slightest doubt" that our engineers will ultimately succeed in discovering how to utilize this enormous supply of power; and when coal is exhausted and water power is inadequate, "it may be that this is the source "from which we shall derive energy for the world's work." This is forecasting well ahead. But it is to the thinkers and the theorists, and the searchers into the esoteric, that there is indebtedness for their directive influences. And the new discoveries which succeed, and the further ideas and potentialities suggested by them, have a stimulating effect upon the workers. And so the history of development is made. Words from the lips of Sir J. J. Thomson, bearing on this point, can be applied to the gas and other industries as well as to pure science: "There never were," he says, "any signs "of an approach to finality in science. As we conquer peak "after peak, we see in front of us regions full of interest and "beauty. But we do not see our goal; we do not see the "horizon. In the distance tower still higher peaks, which "will yield to those who ascend them still wider prospects." The words, simple and expressive, are both inspiriting and impelling. In our special industrial work, it cannot be said that we have yet seen the signs of finality in any one direction. This being so, in it, we may (as those in the higher branches of science) work to conquer peak after peak, with courage, with enthusiasm, and with confidence in the future.

Income-Tax Allowance in Respect of Depreciation.

A MATTER of considerable importance to gas undertakings has been opened up by a letter in our "Correspondence" columns from Mr. W. A. Schultz, who is identified with various Gas Companies—the Ascot among others. It is a question over which there should be no delay in taking collective action, through the Institution of Gas Engineers. A few years ago our correspondent secured, on appeal before the Special Commissioners, in connection with assessments for income-tax, an allowance of 3 per cent. on the present value of all gas plant and machinery belonging to the Companies with which he is identified. But now the Board of Inland Revenue, who are a body of less degree in this matter than the Commissioners of Taxes, have instructed their Surveyors not to allow any depreciation in any circumstances in respect of any portion of gas and water undertakings. But repairs and renewals (excluding extensions and improvements) are to be allowed as working expenses, as and when incurred. It would be interesting to ascertain whether there is any union between this decision of the Board of Inland Revenue and the resolve of the parliamentary authorities last session not to again allow a renewals clause in connection with gas undertakings, but to institute a special purposes fund for certain defined objects. Whether or not the earlier decision has any association with the inception of these fresh instructions to the Surveyors of Taxes is not clear; but the best that can be said for them is that they are monstrous, and that, if not annulled, they will give rise to much dispute and necessity for appeal.

The position created once again emphasizes the ridiculous inconsistency with which the affairs of the departments dealing with the collection of the national revenue are directed. Only a few weeks ago, Somerset House agreed with representative bodies of the electrical industry that, in respect of cables, allowance for depreciation, in assessing for income-tax, may be granted at the rate of 3 per cent. per annum on the written-down value; and on all other plant (exclusive of loose tools, meters, and office furniture) depreciation may be allowed at the rate of 5 per cent. per annum on the written-down value, in addition to the cost of repairs. It is difficult to even surmise what are the distinctions drawn in the official mind between the gas and electrical industries, that the one should be treated on such a different basis from the other. Certain it is that there is no legitimate reason for it. The incongruity proposed to be established in this instance is an extreme absurdity. If the difference is allowed to stand, the Ascot Company (who supply both gas and electricity) would be entitled to an allowance of 3 per cent. on their electric cables, and 5 per cent. on their electricity works and plant; but no depreciation would be allowed "under any "circumstances" in respect of any portion of their gas undertaking. It is a matter of importance, and the instructions must not be permitted to get well established before steps are taken to obtain complete recognition of the same concessions that have been granted to the electrical industry. In the case of that industry the negotiations were protracted before Somerset House, and the representative electrical organizations arrived at a mutual agreement as to an allowance basis. But there was success in the end. This is an encouragement to the gas industry to take up the matter, and that at once.

The Gas Industry and Chemistry.

No industry outside chemical manufacture has been governed so much by chemistry as the gas industry; and the latter has long since recognized its value in directing and carrying its operations, and the applications of its products, to the highest degree of perfection. This recognition is growing. Most gas-works of standing have their own chemical department nowadays, presided over by a chemist who has specialized in the work of the gas industry; and, as a matter of fact, the affairs of an important gas undertaking could not very well be conducted without the services of such an official when its staple product is qualitatively assayed by chemical means for penalty purposes under the Acts of Parliament, and while material purchases and sales of bye-products are made on determinations that are purely chemical. Further, the close identity of the gas industry with the Chair of Gas Engineering and Fuel at the Leeds University is another proof of the recognition by the industry of the value of chemistry in perfecting its methods and results.

With such facts before us as to the practical recognition —a recognition, indeed, that is necessary to the point of

compulsion—by the gas industry of the value of chemistry, there must be protest against the insinuation of Professor Armstrong, in his Presidential Address to the Chemistry Section of the British Association, that there has been failure on the part of the gas industry to appreciate the value of the chemist, and that, owing to this, the industry on its chemical side has fallen, year after year, to a lower state. Quite the reverse is actually the case. Professor Armstrong ascribes the fancied fall of the gas industry to the dominant position occupied in it by the engineer, and to the engineer doing his utmost to exclude the chemist, apparently fearing his competition. Such absurdity and pretension to knowledge (which is not in accord with truth) coming from the lips of Professor Armstrong is astonishing, and quite unpardonable when publicly uttered. That our words are not a whit too harsh, in view of the allegations, is shown by the further statements to which the Professor gave utterance in this connection. "The quality of coal gas is such, espe-"cially since the withdrawal of the sulphur clauses from "the Acts of Parliament by which the industry is regulated, "that gas is almost unusable. Had not chemists uncon-"nected with the industry vastly improved the methods of "burning it, gas would long since have fallen into disuse." It is unnecessary in the columns of the "JOURNAL" to say anything in refutation of these statements. There has been no change in the quality of coal purchased, other than that brought about by the depreciation of the coal workings themselves; and a lower sulphur content in the gas, it is found, is realizable by simple alterations in the methods of carbonization. Professor Armstrong may be advised to get into closer contact with the work of the gas industry before again venturing to allow his tongue to run loose in so baseless an allegation.

Taxes on Gas and Electricity.

Some people are of opinion that the Government made a great mistake when Mr. Lloyd George was elevated to the high office of Chancellor of the Exchequer. A correspondent of the "Daily Telegraph"—by name R. Ashton—is one of them. In his opinion, he could have framed a much better Budget than Mr. Lloyd George has done with the assistance of his colleagues of the Cabinet. There is nothing simpler, R. Ashton thinks, than to construct a budget, and to raise money. All that has to be done is to bluff the people by taxing them indirectly. Sixteen million pounds are to be raised by taxing the agents of light, heat, and sweetness. His proposal is a tax of 3d. per 1000 cubic feet of gas, of 1d. per unit on electricity, of 3d. per gallon on American and foreign petroleum, of ½d. per lb. on sugar; and, in addition, he suggests the reimposition of the export duty on coal. R. Ashton is generous in letting gas off so lightly in comparison with electricity and petroleum, in view of the largeness of the unit of gas in contrast with the unit of electricity and petroleum. It is sufficient for us to talk in this connection of the commodity in which our interests chiefly lie. No doubt R. Ashton thinks himself original; but his idea we recognize as having been "Made in Germany." He calls his heartless finesse an "indirect tax;" it is nothing of the sort. It is, as a matter of fact, a very direct one. Gas could to-day be sold for 2d. to 3d. per 1000 cubic feet less in many places if it were not for the rates and taxes fully assessed gas-works are called upon to bear. This already means an enormous contribution to the financial fruits of taxation direct from the pockets of multitudes of poor consumers of gas for lighting and cooking. To deliberately further tax consumers, by making them pay an additional 3d. per 1000 cubic feet, in the manner proposed by R. Ashton, would be unjust and an act of oppression.

Gas at the White City.

We are pleased to be able to make extended reference in this issue to a nice little demonstration of the utilization of gas for meeting the lighting, heating, and cooking requirements of a small but comfortable residence, which is now being made at the Shepherd's Bush Exhibition. The display, which is one more evidence of the enterprising policy of the Gaslight and Coke Company, had its inception in a suggestion by the Coal Smoke Abatement Society that the Company should join with them in giving a practical illustration of the use of smokeless fuel in a small dwelling. The Company consented; and from last week until the time the exhibition closes, visitors will be provided with an object-lesson which, judging by the interest displayed by those who inspected this part of the Machinery Hall on Saturday afternoon and evening (of which we speak from personal knowledge), should be useful in furthering the interests of gas. This being so, the addition to the White City is a welcome one; and it is matter for regret that the late date at which the arrangements for it were made prevented the exhibit from being earlier got into working order. As is explained elsewhere, what is to be seen is a bungalow, in which one is tempted to sit and dream of blissful week-ends in the country—"far from the madding crowd," but where the gas is laid on. Insistence on this latter simple stipulation is able to transform what would doubtless under any circumstances be a cosy bijou residence into a dwelling in which there may be at hand the greatest of the latest inventions for adding to the comfort of home-life. In the exhibit, no more gas apparatus is in evidence than could be usefully employed in such a sized building; and only such furniture as would be required is to be seen in the rooms. The result is a thoroughly "realistic" demonstration, on which all those who have been concerned in its preparation deserve to be complimented. The "show" to which attention is now drawn does not, of course, constitute the only example of gas lighting in the exhibition. The Keith high-pressure lamps still effectively illuminate a portion of the grounds; and in taking a stroll round, one notices that a good many of the stalls are also lighted by gas.

The Disastrous Explosion at Geneva.

It is a matter for congratulation that it is not often our painful duty to record the occurrence, in connection with the gas industry, of an accident of the appalling character of that which happened at the municipal gas-works at Geneva on Monday afternoon last week, a brief account of which is given elsewhere. Considering the magnitude of the industry, and the nature of its staple product, the extent of the personal injury and loss of life attendant upon it cannot, we think, be regarded as abnormal. Regrettable accidents unhappily occur, not always as the result of carelessness, in carrying on most operations on a large scale connected with the production of commodities or the conveyance of people from place to place. A defective safety lamp brings about a colliery explosion; ineffectually-closed points on a railway lead to the wrecking of a train; and a flaw in a rod in the reversing gear of a winding-engine sends an empty cage crashing down a mine shaft on to another freighted with human beings. A small defect in each instance; but how potent for mischief! In the Geneva case, a large volume of gas escaped—whether in the changing of a purifier or in the process of laying a main it is impossible to say from the accounts to hand—and was ignited, it may have been by a spark from a tool or by some naked light; but on this point there is no definite information. There will doubtless be a searching inquiry as to the cause of the explosion; but, unfortunately, those who would have been able to give the most useful evidence in regard to it have been laid in their last resting-place. If it was not brought about by any negligence on their part, they are, as too many others have been, innocent victims; but if it was, they have paid the penalty with their lives. Their punishment, however, does not alleviate the sorrow and suffering they have caused to others. This terrible disaster serves to emphasize once more the necessity for the exercise of the strictest supervision over workmen, when they are engaged in operations on the portions of gas-works plant from which gas is likely to be liberated; for it is acknowledged that familiarity with danger begets contempt for it. It is to be hoped that something may come to light which will make clear the cause of the catastrophe, and furnish information that will be calculated to prevent an accident of a similar nature elsewhere. Meanwhile, we tender to the Municipality of Geneva, and especially to their Gas Engineer, M. Des Gouttes, our sincere sympathy with them in the calamity which has overtaken them. This feeling, we are sure, is shared by all who have the control of gas-works.

Daylight Saving Bill Dead.

The fate of the Daylight Saving Bill has been sealed again for this session. Inquiry, session after session, has shown that there would be certain advantages to the community by the advancing of the hands of the clock in the summer time; but the difficulty appears to be to make the change without affecting various important interests. The Committee to whom the Bil

was referred this session have heard further evidence, and have also considered the mass of testimony laid before the Committee who sat last year to consider the same question. While appreciating the efforts of the prime mover in the matter (Mr. W. Willett), the Committee's view is that—having regard to the great diversity of opinion existing upon the proposals of the Bill, and to the grave doubts which have been expressed as to whether the objects of the measure can be attained by legislation without giving rise (in cases involving important interests) to serious inconvenience—the Bill should not be proceeded with. Had they recommended otherwise, the Government would not have had time to devote to the passing of the Bill through the final stages this session; and the measure would have gone to the wall without a doubt. As it is, all that can be done—and it is quite sufficient—is for employers who want to make a change in accordance with the proposals of the originator of the scheme to arrange to commence the hours of work earlier in the summer, and thus advance the hours of leaving off. That is not the same thing as a universal obligation; but the beauty of it is that no statutory authority is needed to do it. Though the Bill is dead, there appears to be no general mourning at its loss; and so the feeling of indifference that has existed since the proposal was first introduced to an amused country is continued. The vendors of the means of artificial illumination are among those who will not regret the happy despatch of the Bill.

The Trades Union Congress Agenda.

The Trades Union Congress for this year—the forty-second of the series—will take place next week at Ipswich; and the *agenda* for the meeting has just been issued. Judging from the length of it, the six days over which the meeting is to extend should prove none too long a time in which to get through the business. There are over a hundred resolutions to be submitted for discussion; and these, as usual, cover a very wide range indeed. Among the more interesting of them, is one (referring to unemployment) which demands the immediate institution of work of public utility, and declares that no system of labour exchanges or compulsory State insurance will be accepted unless the Trade Unions of the country have a share in the management, and they are of a non-contributory character. This is sent in by the Gas Workers' and General Labourers' Union. In another direction, an insurance scheme of a non-contributory character does not find favour; and one resolution is to the effect that labour exchanges will not tend in the slightest degree to provide more employment, and that the proposed insurance is a tacit recognition of the evil, that it means the retention of a reserve army of unemployed labour for the use of the employing class, that it cannot be operative in the case of casual workers, and, moreover, that it will result in still fewer workers being employed in order to reduce to a minimum the insurance paid by the employers. Then there are several resolutions designed to prevent labour exchanges being used in case of trade disputes. The London Glass Blowers' Union express the view that the State insurance scheme will reduce the worker to a "position of servile semi-starvation." Charges of sweating and underselling will be brought against the Salvation Army in connection with the operation of a certain factory of theirs; and there is a proposal to condemn the practice of international importation and exportation of workmen to act as blacklegs during trade disputes. Of course, no Trade Union Congress would be complete without a motion in favour of the enforcement of a universal eight-hour working day.

Some Miscellaneous Resolutions.

The matters named above would alone serve to open up a very fair number of industrial questions; but they by no means fully indicate the probable scope of the discussions. The advisability of instituting compulsory arbitration for the settlement of trade disputes is a very proper question for consideration for an industrial congress; but some of the other matters set down are perhaps hardly so likely to meet with adequate treatment at the hands of the delegates. There are, for instance, numerous resolutions dealing with education; and one which is worth special reference wishes an emphatic protest to be entered against the attempt of certain employers to compel employees to join the territorial forces, and views this latest military measure as "an unscrupulous and sinister attempt to introduce compulsory military service in its most invidious form; the compulsion falling upon the most economically dependent class—namely, upon the workers—leaving the aristocracy free from such service, except to direct and officer the forces in the interests of the propertied classes." It further desires the conference to place on record that it is absolutely inconsistent with the policy of Trade Unionists for them to enlist in this force, as they are thereby liable to be called out in times of industrial disputes to quell, and possibly shoot down, their fellow-workers who are struggling to better their conditions. At least one motion is in terms of gratitude; for the Miners' Federation wish to thank the Government and all parties in the House of Commons for the Old-Age Pensions Act. Even they, however, are not satisfied, inasmuch as they press for the reduction of the pension age to 60 years, and the abolition of the disqualifications in the present Act. Many political matters will be introduced by the Parliamentary Committee.

Eight-Hours Act in Operation.

Those who have been looking with some interest to the first results of the working of the new Miners' Eight-Hours Act, will note the report of the Chairman of the Cardiff Chamber of Commerce, who states that the trade returns for the month of July are "disappointing and disconcerting." The figures for Cardiff show a decrease in coal exports, as compared with July of last year, of 126,865 tons; while the Bristol Channel ports are down to the extent of nearly 500,000 tons. This is attributed to the stoppages and disputes which have arisen over the introduction of the Eight Hours Act; and the Chairman remarks that the predictions of the miners' leaders that the Act would not reduce the output, have been so far falsified. In his own mind, he has no doubt that the Act will result in a permanent reduction of the output. It may be that the Chairman of the Cardiff Chamber of Commerce is, in this expression of opinion, referring only to the South Wales coalfield; but, at any rate, what he says tends to confirm predictions which were made in many quarters before the Act was passed as to what its effect on the output would be. There is also, according to the Cardiff correspondent of the "Financial Times," reason for believing that a large section of the miners are disappointed with the Act, inasmuch as it has limited their earning powers. The day men are satisfied, simply because they are employed on a day wage; but the hewers, who are paid according to the amount of coal cut, are in numerous cases dissatisfied. These factors are, it is said, exercising an awkward influence on the market, and are making business of any importance for delivery over periods ahead very difficult to bring to a conclusion, as colliery owners, fully alive to the risks they are taking, justifiably demand comparatively high figures. The clause in the Act permitting the working of an additional hour on sixty days in the year has already been a subject for magisterial decision. The South Wales owners called on the men to work this additional hour; but the Miners' Federation decided that the whole of their members should refuse to work beyond the eight hours legalized by the Act. The South Wales members therefore declined to work the additional hour; and as a result the owners brought a test-case before the Rhondda Stipendiary Magistrate, to ascertain whether they could compel the men to work. This case was decided against the men; and the South Wales Federation thereupon decided to lay the facts before the Executive of the National Federation, for them to settle what further action should be taken in the matter. The men are so firmly convinced that the sixty-hours clause is an entirely optional one, that there is no doubt the decision will be appealed against and the case fought by the Federation, if necessary, right up to the House of Lords. The brief operation of the Act has, therefore, already resulted in a falling-off in the South Wales output of coal, and in the bringing about of what will in all probability prove to be long and costly litigation.

Gas-Engine Reliability.—Writing on this subject in "Cassier's Magazine" for September, Mr. Percy R. Allen says: "Whether the large gas-engines can be safely relied upon to work continuously depends chiefly upon whether they are purchased from experienced manufacturers in the first instance and whether they are installed and supervised by intelligent and unprejudiced men afterwards. Practical experience has demonstrated that a large power plant can be worked with the same immunity from breakdowns as a steam plant, and at about one-half the operating costs. Numerous log sheets of actual runs are available which show that large gas-engines can be run practically continuously."

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 591.)

BUSINESS on the Stock Exchange last week was of the usual seasonable dimensions; and, it being account week, fresh business was especially quiet. The movements were irregular. The leading markets were almost devoid of all feature; but in the more speculative lines there was considerable agitation, and in the American there was a material fall in prices. On the opening day, things moved in a mixed way. The gilt-edged group were dull; Consols lost a fraction; but Railways were more cheerful. In the Foreign Market, there was a fair demand. Americans were very sensitive. On Tuesday, a firmer tone was perceptible in many lines, but again the gilt-edged division took the other road. Railways were firm; and the Foreign Market bright and active. This attitude was fairly well maintained on Wednesday; but Railways were rather inclined to yield. Commotion in Americans was the chief characteristic of Thursday; and the rest were mostly quiet and unmoved. Friday was very quiet. Things all round were dull, and mostly with lower prices; Americans being still much perturbed. Saturday was, of course, inactive, and the position of the previous day underwent hardly any change. In the Money Market, there was no new feature. The supply was plentiful, and the Stock Exchange demand made no impression at all on rates. Discount eased down before the close. Business in the Gas Market was very fair considering the holiday season; and the general tendency was capital—showing the well-sustained popularity of gas securities as an investment. A large number of quotations advanced; and others would be bound to advance at the first inquiry. The only adverse movement was special—viz., a sharp set-back in Sheffields. In Gaslight and Coke issues, the ordinary was moderately active, and steady at the old figures of 104 to 104¾. The secured issues were hardly touched; a bargain or two in the maximum at from 88 to 88½; and one in the preference at 105. South Metropolitan was quiet and unchanged at from 119 to 120; and the debenture made 85½. Commercials were not dealt in. Among the Suburban and Provincial Group, Alliance and Dublin old marked 17⅝, ditto new 12⅞, Bromley C 108¾ and 109¾, Ilford A 143, while several others advanced without business being done. The Continental companies were quiet and unchanged. Imperial was done at 179¼ to 179¾, ditto debenture at 96 and 96¼, Union at 96 and 96¾, and European fully-paid at 24⅝. Among the undertakings of the remoter world, Buenos Ayres changed hands at 13⅞ and 13⅝, Cape Town at 4 free, ditto debenture at 82½ and 83, Melbourne 4½ per cent. at 103¾, Primitiva at 7 and 7 1/16, River Plate at from 16¾ to 16 15/16, and San Paulo at 14⅝.

ELECTRICITY SUPPLY MEMORANDA.

Discontent in the Electrical Manufacturing Industry—Causes and Effects—A Power Company's Prospects—The Central Station and Power Business—The End of the Gas Industry—Wanted, a School of Electric Cookery, and an Explanation.

THERE has been a plethora of matters to comment upon recently in connection with electricity supply; and it has been impossible to overtake all the subjects of passing interest. There is one, the position of the electrical manufacturing industry, on which, several weeks ago, a few remarks were made. Since then Messrs. Crompton and Co. and the General Electric Company, Limited, have held their meetings. The speeches of Mr. J. Trotter at the former and of Mr. G. Byng at the latter contained throughout a vein of discontent with the conditions under which electrical manufacturers have to work. In the case of the Crompton Company, no dividend has been declared; and in that of the General Electric Company (who have many irons in the fire in connection with electrical appliances) a dividend of 5 per cent. has been paid. Crompton's gross profits, in fact, were reduced by £23,000; and the net profit was only £10,000, in place of £31,000. There is no feeling of exultation on our part over the position in which the electrical manufacturers find themselves; but, in a measure, their position is merely an indication of the degree of prosperity (or whatever is the correct term for the position) in the electricity supply industry. General trade depression is given high place in the causes that contribute to the continuance of the cloud that hangs steadfastly over the manufacturing industry, though that cloud had got well set before general trade fell to the low ebb of immediate past years. The Government, too, is abused for keeping an open door, which allows electrical plant and appliances to come into this country with brazen freedom, while the electrical manufacturers of the country cannot gain an entrance into other countries without paying substantially for the privilege. The growth in national expenditure of an unproductive order is regarded as another contributory cause; and to this expenditure manufacturers have to pay their share. But the main cause is no doubt the mad rush of local authorities for things electrical several years ago, and the slump that has supervened in their demands, owing to prognostications of years ago not having been fulfilled, except in comparatively few cases. Now surmounting the unenviable position of numerous electricity supply concerns, is the consumption-reducing metallic filament lamp, which has again deferred the demand for extensions. The rush of years ago brought into being a large number of firms, to sustain which in a state of fair success, the demands of the electrical industry would have had to be maintained at high-water mark—a condition which it was inevitable could not be fulfilled. The result is an unhealthy competition that is good for no one engaged in the manufacturing industry.

To keep their shop doors open, the manufacturers are extending the field of their operations. Cromptons, for instance, are giving attention to the manufacture of non-electrical appliances which their machinery and tools are capable of turning out. No one can blame them. Not many weeks since, we were describing a fast-boiling kettle for gas-stoves which is being produced in an electrical factory. If the electrical industry cannot find employment for works machinery and tools that have been specially laid down for the production of electrical plant and appliances, the broadening of the basis of the operations of the factories is the only hope of salvation. The General Electric Company deal chiefly in appliances for the utilization of electricity; and they have taken up at appropriate times several really excellent lines. Notwithstanding this, in certain of the seven factories of the Company, there have had to be a reduction of hands and a shortening of hours. But enough of the troubles of the manufacturers. The General Electric Company are the makers in this country of carbons for electric arc lamps, and of Osram metallic filament lamps. Gas-works are drawn upon for the carbon used for the former; and the Company's factory is the only one in England at which flame arc carbons are made. It is interesting to learn that the enterprise has succeeded well, and that in this direction the Company can compete with Continental firms. The sale of Osram lamps, it is reported, has been large; but the Company must be feeling increasingly the pressure of competition, which has brought prices down with such a run, although the lamps are expensive to make. Mr. Byng is quite justified in saying that "no invention since the advent of electric lighting has produced an equal effect." One of the effects has been the disorganization somewhat of the electricity supply industry; and all central station engineers are not prepared, in their present circumstances, to endorse the optimistic assertion of Mr. Byng that, in the result, the lamp will be one of the greatest benefits to the whole industry. However, it is a point of technical interest to learn that the factory at Hammersmith (at which these lamps are made) is completed, and is turning out lamps equal in quality in every respect to those produced on the Continent. Soon the Company will be employing over 1000 hands in this department; and in it Englishmen have learned as quickly how to make efficient lamps as their foreign competitors. It is a change to hear that there are things in which Englishmen can do as well as, if not excel, their German cousins.

Just recently it was announced that the Directors of the Power Company operating in the Newcastle-on-Tyne district had felt it incumbent upon them to pass the interim dividend. The Directors of the Lancashire Power Company, with which is affiliated the Lancashire Power Construction Company, have not felt it incumbent upon them to make a similar announcement, as, if memory is not fickle, they have never had the funds with which to recommend a dividend. No profit distribution with them has been a normal condition. But there was an air of cheerfulness, and symptoms of rising hopes, in the last report and at the recent meeting—at the Directors' end of the room. There has been a reorganization of the Company's affairs; and big results are anticipated. The Board of Trade, too, have given their assent to the transfer to the Company of a number of Electric Lighting Orders from local authorities. But we have never known local authorities who are willing to part with their Orders, if they can detect, or fancy they can detect, a ray of hope of making something out of the business on their own account. To have to part, is to swallow a bitter pill. Such Orders are generally "small fry," and are only abandoned by the holders because there is nothing worth having in them. Then, again, the Directors are in a fever of excitement because the Local Government Board have counselled the Radcliffe authority to take a supply of electricity from the Company in preference to putting down a generating station of their own. Another matter over which the Board extend their congratulations to a longing proprietary is that at June 30 custom amounting to approximately 6590-horse power had been connected with the cables; and an additional 1160-horse power had been arranged for. But the power business does not appear to be very profitable. In the speech at the meeting, it was stated that the output had increased by something like 30 per cent.; but the revenue increase was only £1500. At this rate of financial progress, the shareholders must not pitch their hopes too high. Originally, it was anticipated that the cotton-mill owners would receive the Company with open arms. They have not done so. On the other hand, collieries have been the ones to clasp the Company. But as yet no dividend. The weary shareholders will be glad to see the fruits of these developments before they enter largely and heartily into the cheerfulness of the Directors. From the investment point of view, Power Companies have proved, generally speaking, poor and disheartening enterprises.

The changed aspect of the affairs of the West Ham electricity undertaking—believed by those who look on the bright side of the picture to be entirely due to the expansion of the power business, while others who critically examine the accounts are of opinion that a no inconsiderable part of the apparent improvement is due to temporary curtailment of expenditure in certain items of the revenue account—has induced "The Electrician"

to once again urge upon central station engineers the importance of cultivating a large motor load. Of course, it is all very well to keep rubbing-in this advice; the industry cannot be in the "pink of condition" to need it. However that may be, the districts in which large motor loads are available are few and far between. And, moreover, a study of the accounts of many municipal authorities does not convince us there is much profit in some of the newly acquired motor loads at the price at which they are booked or hooked. Coal has been cheaper; and several of the other expenses on revenue account have not been increased by taking on day motor loads to an extent that does not necessitate additional generating plant. Nevertheless, the final net surpluses in the accounts have not been beneficially affected. West Ham is not the only direction in which to look for effects; and too much may be made of the account outcome of the past year's working without taking into consideration all the details. Our contemporary, in its reference to this matter, states that "the check experienced by most central stations in the sale of electrical energy for lighting purposes, due chiefly—but not entirely—to the adoption of metal filament lamps, has emphasized the advantages of a large power load." We wonder what was in the mind of the writer when he wrote the words "but not entirely." May we suggest as causes first coming to mind that are covered by the qualifying phrase, inverted incandescent gas-burners, the increasing economy of gas lighting, the failures of electricity supply, the consequent annoyance caused to those who have put their trust in electricity supply, and the shocks caused not by contact with electrical wires, but by quarterly electricity accounts. Those who are generous will try to trace in these words the evidence of hope resting on a firm foundation: "There is, of course, some compensation in the fact that the advent of improved lamps is always likely to be accompanied by an influx of new consumers, until the time arrives when electric light will have become the customary illuminant." But what about the influx caused by the improved lamps of the gas industry?

While on this point, an article in the "Industrial Supplement" of the same paper read in conjunction with the above statement lead us to wonder whether an uncanny omniscience, or something else, is possessed by the editorial staff of our contemporary. Electric lighting, we have just seen, is to become the universal illuminant; and now the writer of the editorial notes in the "Industrial Supplement," to give contradiction to our recent charge of a wavering between pessimism and optimism on his part, says that the day is not far distant when the use of gas-cookers will be near vanishing-point. There is no error in our reading. "We are confident," says this prophet of evil, "that the time is shortly coming when electricity will be a much more serious competitor in domestic heating and cooking, and that, though there may be now 600,000 gas-cookers in use in the London area, the time when they will be much less numerous and *even near to vanishing-point, is not so far off as some people seem to think*." We will not say all the things that might be said about this. But just previously the same writer admits his knowledge of the existence of a proverb "relating to the volume of sound emanating from empty vessels." He thinks perhaps the statement may apply to "gasometers." It may also apply to other things and persons—self-constituted prophets, for example. One word in the private ear of our prophetic friend, as his engineering knowledge is a little at fault. The vessels that (say) a century ago performed the dual function of measuring and holding gas are not in use now. Gasholders and gas-meters are structures of extensive current use; but "gasometers" have been left far behind in history. But let us pause to contemplate the bigness of the scrap heap those holders and meters are going to make in the very near future! The gentleman blessed with the gift of foresight might add to the interest as well as the amusement of his readers by stating the probable dimensions of the scrap-heap.

Heating and cooking is a branch of business that central station engineers are, in addition to power, freely bidden to cultivate, selling current at 1d. per unit for the purpose, in order to help to make up for lost units due to the metallic filament lamp. The loss is a big one; and requires some making up. Success in this direction does not come by leaps and bounds. "Start cookery schools" is the advice tendered by the writer of "Installation Topics in the Electrical Times." We agree with him as to the necessity of such schools for electrical cooking; and there ought to be a subsequent course in an electrical school of engineering, so that the housewife or the cook may know how to properly manage an electric cooking-stove, and to do any small repairs requiring prompt attention when things do not go right, and there is danger of the dinner being spoilt. We do not admit that there is much difficulty in learning how to use a gas-cooker. There are hundreds of thousands in London alone. But there have not been a similar number of housewives in London who have attended cookery schools. The writer in our contemporary is candid. "It is useless," he says, "to describe the merits of an [electric] oven in the showroom; and it is as nearly as useless, and it is expensive, to instal one on trial." We do not follow our friend, as a little later it is found that he holds by the belief that it is possible to soon realize the superiority of electric cooking over any other system. If it is possible to so soon do this in a cookery school, it cannot be a matter of great difficulty to realize it under other circumstances. To fix such an apparatus with such superior merits, and to send a qualified instructress to the house, ought to ensure its continuance in place and use. Another remark of our friend is that "the price paid for current, although an important factor, is seldom the determining one; and, at 1½d. or less per unit, electric cooking in 'intelligent hands' will compare favourably with gas at 2s. 6d." With confidence, it is suggested to the writer that this is empty assertion. Take 14-candle gas as being equal to 500 B.Th.U. per cubic foot, 1000 cubic feet will be equal to 500,000 B.Th.U. The 2s. 6d. would purchase 20 units of electricity at 1½d.; and the 20 units will be equal to less than 70,000 B.Th.U. Will the writer of "Installation Topics" kindly favour us by stating the grounds for his assertion; and also say what he thinks becomes of the difference of upwards of 430,000 B.Th.U. that are in the 1000 cubic feet of gas as compared with the 20 units of electricity? If not instructed, we might be amused; so that he would have the gratification and the happiness of knowing that his labour has not been entirely lost.

PERSONAL.

Mr. James Diggle, of Heywood, who is at present superintending the construction of sewage works at Bury, has been appointed Borough Surveyor and Water-Works Engineer to the Hyde Corporation.

Mr. George P. Lawton, chief clerk at the Burslem Gas-Works, was on Monday last week presented with a handsome clock, by the officials and workmen of the Gas Department, on the occasion of his marriage. The presentation was made by Mr. Edward Jones, the Engineer and Manager, who spoke of Mr. Lawton in felicitous terms, and wished for him and his wife long life and much happiness. Mr. Lawton feelingly expressed his thanks to the subscribers.

OBITUARY.

JOSIAH CHANDLER.

We regret to record the death of Mr. Josiah Chandler, which took place last Wednesday, at his residence, Brixton Hill, S.W. Some time ago, Mr. Chandler had to undergo a serious operation, which was successfully performed. But he never thoroughly regained his former strength; and about five weeks ago he was confined to his room by illness to which he succumbed.

Mr. Chandler will be remembered by a large number of gas engineers in association with his brother, Mr. Samuel Chandler, who are so well known in connection with washer-scrubbers. It is now some thirty-five years since the late Mr. S. Chandler, in conjunction with the late Mr. D. Hulett, patented a horizontal revolving washer, which was worked at the Bromley-by-Bow station of the old Imperial Gas Company. This, however, did not produce results such as were needed in apparatus of this kind. Still, it was the forerunner of the more efficient washer produced later by Messrs. Kirkham, Hulett, and Chandler, Limited. Shortly afterwards, the subject of this notice and his brother Samuel joined their father and Mr. Hulett in patenting improved gas-washing apparatus; and at this juncture success was achieved, and a large business followed in England and many other countries. Since the demise of Mr. Josiah Chandler, there remains only one of the founders of Messrs. Kirkham, Hulett, and Chandler, Limited—viz., Mr. S. Chandler; Messrs. D. Hulett, T. N. Kirkham, and S. Chandler the elder having also passed away. We sympathize with the last surviving member of this well-known firm as well as with the family of the one just removed, in the loss they have sustained.

The First London Square Lighted with Gas.—Finsbury Square, according to a correspondent of the "Westminster Gazette," was the first public place lighted with gas, though some experimental lamps had previously been displayed in front of Carlton House.

Electric Light Troubles.—In a report in the "Daily Telegraph" as to the destructive fire in Cannon Street last week, among the troubles encountered by the firemen were the electric light wires. At all events, that is what we gather from the remark that "the electric wires constituted a constant menace."

The Commercial Production of Hydrogen.—It is reported in a recent number of the "Zeitschrift für Beleuchtungswesen" that a Company has been formed, with a capital of £62,500, for the exploitation of a process for the manufacture of hydrogen of a high degree of purity. Among the founders of the Company are the Dellwik-Fleischer Water-Gas Company, of Frankfort-on-the-Main; and the process which the new Company will work is known as the "Dellwik-Fleischer Hydrogen Process." The gas made by it is said to contain about 99 per cent. of hydrogen; and the process is stated to be of a very simple nature, and to entail very small working charges. The apparatus has already been employed by the Prussian military authorities for the manufacture of hydrogen for charging balloons. The name of the new Company is the International Hydrogen Company (Internationale Wasserstoff-Akt.-Ges.); and the Board of Directors includes, in addition to representatives of German banks and financial institutions, Herr R. Blum, Manager of the Berlin-Anhalt Engineering Company, and Fräulein Agnes Fleischer, of Wiesbaden.

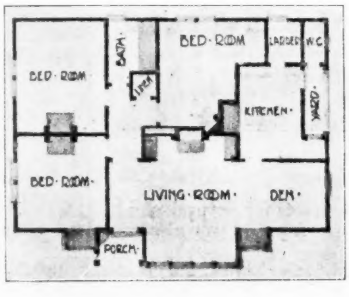
GAS EXHIBIT AT THE WHITE CITY.

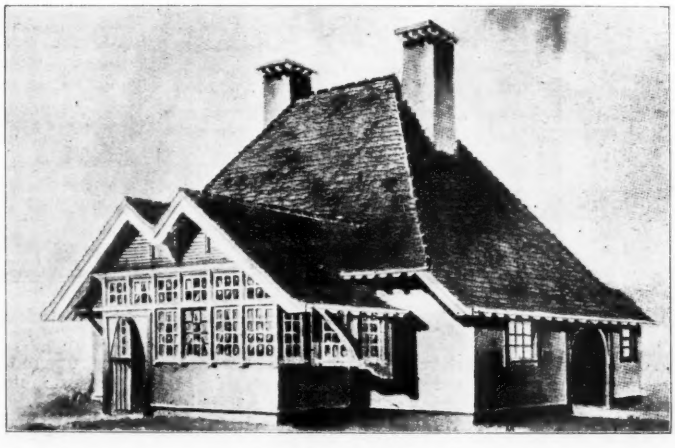
An Attractive Bungalow.

THE project which we were able to announce some weeks ago had been formed by the Gaslight and Coke Company to secure a small representative display of the domestic uses of gas in connection with the Imperial International Exhibition which is being held at the White City, Shepherd's Bush, is now an accomplished fact; and those who have been concerned with the carrying into effect of the idea, may fairly be congratulated upon the result. For the guidance of intending visitors, it should be pointed out that the exhibit is to be found in the Coal Smoke Abatement Section of the Machinery Hall. As previously explained by the General Manager of the Gaslight and Coke Company (Mr. D. Milne Watson), about the end of April the Company were approached by the Coal Smoke Abatement Society with a request that they should join with them in providing an illustration of how a cottage or bungalow can be smokelessly heated and lighted; and the Company agreed to the suggestion.

A country bungalow, covering a space of some 1100 square feet, has been erected by the Alnwick Foundry and Engineering Company, and suitably furnished throughout by Messrs. Oetzmann and Co.; and the portion of the task undertaken by the Gaslight and Coke Company has been the fitting-up of the various rooms with specimens of modern gas appliances for lighting, heating, and cooking. This work has been carried out under the supervision of Mr. E. Pilbrow, the Inspector-in-Charge at Kensington and Harwood Terrace; and there have been fixed throughout just such fittings as would be most suitable for use in a building of the character and size of that shown. Altogether the impression given to the visitors is that they are inspecting a bungalow furnished and fitted on really practical work-a-day lines—which is quite correct; and they therefore find themselves fully prepared to consider the advantages of all that they see there in relation to their own homes. The installation was only completed about the middle of last week; but it has already proved itself a most attractive exhibit. On Saturday afternoon and evening, for instance, the number of visitors who passed through the bungalow must have averaged several hundreds an hour. There is no undue amount of advertising outside the building; all that appears being the simple announcement: "Lighting of this bungalow and installation of apparatus for heating and cooking by smokeless fuel carried out by the Gaslight and Coke Company, Horseferry Road, S.W."

In attempting a description of the exhibit, it is necessary to take it as a whole, instead of confining attention solely to the gas portion; and reference may first be made to the bungalow itself, the chief points of which were indicated to a representative of the "JOURNAL" by the architect, Mr. M. Andrew Sell. Over the porch are to be seen the words "Ye Hut—The Port of Ease from Travellers' Toil;" and the building by no means belies the latter portion of its name. At the side of the door is an old-fashioned iron lantern, which was made and supplied in twenty-four hours by Messrs. Evered and Co., and which is in complete harmony with the general scheme of the building. The burner used in this lantern (as on the other fittings, with the exceptions that will be noted) is the New Inverted Company's latest pattern—the "Nico Medium" burner, No. 6. As will be seen from the accompanying plan, the bungalow consists of three bedrooms, a general living-room (which can, if desired, be divided off into two rooms), bath-room, kitchen, and larder. The special feature is the simplicity of the planning. All the bed-rooms and the bath-room are entered off a single lobby, 6 feet long (thus saving the usual waste of space in passages), and are immediately accessible from the main living-room. This latter is a particularly fine room, 27 feet long, provided with a most tempting old-world ingle-nook, and well-lighted from a 12-foot bay. The open timbered ceiling of the room is most attractive; and altogether it may be said that





Gas-Fitted Bungalow at the White City.

the designer has succeeded in his endeavour to rise above the hackneyed type of country bungalow. The walls are constructed, both inside and out, with a patent fire-proof and damp-resisting air-tight material, with a 4-inch air-space in between, which acts as a non-conductor of heat or cold. May it be added, for the benefit of readers who are on the look-out for a cosy week-end residence, that the cost of such a bungalow as here described and illustrated is £300, erected in England?

Stepping into the living-room from the front entrance, the furniture is seen to be in dark oak. The lighting is by means of six wall-brackets and a large centre pendant—all in wrought iron and copper. The wall-brackets throughout are by Messrs. Kempton and Sons, and the pendants by Messrs. Evered and Co. and Messrs. Benson and Co. The brackets are in all cases fitted with "Nico Medium" burners; and the centre lights with large size "Nico" burners. Two of the wall-brackets are in the ingle-nook. The fire is an Edgar "Blenheim," fitted in a dog grate, in a blue tiled recess. Mention must be made of the handsome shades with which the lights in the various rooms are provided, and which have been supplied by Messrs. Ellis, Simpson, and Saunders. Throughout, the burners are operated by the pneumatic switch, fitted with either tumbler or pull-and-push movement; and in the living-room there are two models to show the working of the system in connection with upright and inverted mantles respectively. These are of assistance in explaining to visitors how easily the principle of switching on and off can be applied to gas lighting.

In the first bed-room, all the furniture is white enamelled, and is in the Adam style. The fire is a Main "Malvern" nursery pattern. The second bed-room is furnished in mahogany; the fire being a Wilson and Mathieson "Sheraton." In both these rooms, the pneumatic switches connected with brackets over the head of the twin-beds are arranged so that the lights can be turned up on entering the door and extinguished by means of a flexible switch hanging down at the side of the beds. In each room there is a pendant over the dressing-table, fitted with the large size New Inverted Company's burners. The third bed-room is furnished in oak, and has a Fletcher-Russell "K.N." fire. The lighting is by means of three wall-brackets. In these rooms, again, all the fittings are in wrought-iron and copper.

The bath-room is provided with a Ewart No. 3 geyser (shown in continuous action) for the bath, and a "Gem" lavatory geyser by the same firm, fitted with a shower. Warmth is furnished by a Richmond "Surrey" condensing stove; and in the adjacent corridor there is for the same purpose a Wright "St. Andrew" gas-steam radiator.

The kitchen is supplied with hot and cold water by means of a Wilson and Mathieson circulator or a Davey and Roberts coke-heated boiler. These coke-boilers are now used extensively in the Company's district—particularly in large houses where gas is used entirely for cooking and heating, and where the coke-boiler is in consequence found to be a convenient method of burning up refuse, &c. The cooker is one of the "New Davis" screwless pattern, enamelled steel inside and out, with the hot-plate and oven-door heavily nickelled; and on top is a Serné patent hot-closet, designed for keeping warm plates, &c., by utilizing the waste heat from the oven and hot-plate burners. Under the closet there is a small atmospheric burner which can be lighted when neither the oven nor the hot-plate is in use. The cooker, circulator, and coke-boiler are fitted in a tiled recess, at the side of which is a swing bracket fitted with a flat-flame burner, for the purpose of throwing light on the culinary operations. The general lighting of the kitchen is by means of two No. 2 Kern vertical burners.

This is a demonstration of lighting, heating, and cooking arrangements precisely as one would expect to find them in actual practice in any well-regulated home of the style and size of the White City Bungalow.

FATAL EXPLOSION AT THE GENEVA GAS-WORKS.

We regret to have to record the occurrence, on Monday afternoon of last week, of a disastrous explosion at the municipal gas-works at Geneva, as the result of which thirteen people were killed, a number of others were injured, and considerable damage was done to the works and to the buildings in the neighbourhood. As some of our readers may be aware, the works are situated in the south-west portion of the city, not far from the junction of the Rivers Rhône and Arve. They are practically on the banks of the former river, and are bounded on the south by the Boulevard de St. Georges. They have gradually taken the place of the old works dating from the forties, and in all respects may be regarded as quite up to date. An idea may be formed of their capacity when it is mentioned that in the year ending Dec. 31, 1907, the quantity of coal carbonized was about 31,400 metric tons, which was an increase of 3000 tons on the preceding year; and the make of gas was something like 379 million cubic feet, about 11½ per cent. of which was carburetted water gas. Within the boundary of the works is a building constituting the Swiss branch of the Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz, of Paris; the business being carried on under the supervision of M. Masset, one of their Engineers. The Municipal Gas Engineer is M. Des Gouttes, who was not on the works at the time of the occurrence.

So far as can be gathered from the somewhat contradictory reports which have reached us, work seems to have been going on much as usual, when shortly after four o'clock the whole neighbourhood was alarmed by a terrific explosion, followed by a great outburst of flame. The effect on the windows and fronts of the houses in the vicinity can well be imagined. An excited crowd was soon making for the scene; but, thanks to the prompt action of the authorities, the approaches to the gas-works were kept clear. Within the works, the scene was terrible to witness. The purifier-house, which also contained the governors, was in ruins, and a large comparatively new gasholder, capable, according to one report, of containing about 1¾ million cubic feet, had been

The Geneva Gas-Works after the Explosion.

brought down. Through the courtesy of a correspondent, we are able to give our readers an idea of the extent of the damage.

How the catastrophe was caused has not so far been definitely ascertained; but it appears that a main was being put down at the time, and if, by inadvertence, gas was allowed to escape, its ignition by some neighbouring naked light or by a spark from a tool can be quite easily understood. But whatever the cause, the effects were appalling. We read of workmen being shockingly mutilated, and of portions of bodies being found in an adjacent cemetery. Rescue and first-aid work were promptly commenced; the wounded being subsequently removed to hospitals, and the dead to suitable mortuaries. Among these were M. Georges Béguet, an engineer connected with the works, M. Masset, who has been already referred to, and M. de Parvillée, an engineer from Paris. The last-named gentleman, in company with an English engineer, Mr. Bernard Moore, was on a visit to Geneva. They had arranged to have a trip on the lake on the day of the accident; but M. de Parvillée changed his mind, and visited the gas-works with his friend M. Béguet. It was for him an unfortunate alteration of plans. As in most catastrophes, there were some remarkable escapes.

On the night of the explosion, the consumers of gas were cautioned by the municipal authorities against using gas, except under instructions from the officials of the Gas Department; and the lighting of the streets for several nights had to be done by suspended lanterns. A patrol was also organized to ensure the public safety.

From the highest to the lowest, the greatest sympathy has been expressed for the sufferers by the accident. The State Council addressed a letter of condolence to the Administrative Council, and telegrams couched in similar language were sent by the Municipalities of Lausanne, Vevey, St. Gall, Neufchâtel, and Fribourg. The city was practically in mourning—public amusements and functions being suspended; and subscriptions were opened for the families of the victims.

The funeral took place on Thursday, and was quite an imposing ceremony, being attended by members of the Administrative Council, representatives of the State Council, a large number of the officials, M. Basso, the Consul-General of Italy at Geneva (the majority of the victims being Italians), and M. Des Gouttes. A long procession, consisting of nine hearses and several carriages, accompanied by representatives of various societies and the Italian colony, with their flags tied up with crape, was formed shortly after midday, and started for the cemetery, which was reached by two o'clock. The interment was witnessed by a large concourse of people. Earlier in the day, the body of M. Masset was cremated; and that of M. de Parvillée was sent on Friday to Ville d'Avray, near Paris.

Presentations to Mr. John Bond.

In the "Journal" for the 22nd of June, reference was made to the approaching marriage of Mr. John Bond, the Gas Engineer of the Southport Corporation, to Miss Hankinson, of Alvechurch, Birmingham. It will be solemnized to-morrow; and the prospective happy event afforded the employees of the Gas Department at Eastbank Street an opportunity of showing in a tangible way their high regard and esteem for their chief. It took the form of a presentation, which was made last Thursday evening, on behalf of the subscribers, by Mr. J. E. Blundell, the Superintendent of the Gas Department. Mr. Blundell said that as soon as the subject of a presentation was broached, it received the enthusiastic support of the men, from one end of the department to the other. He was only voicing what each one felt when he asked Mr. Bond to receive the presentation (consisting of a canteen of cutlery) in the spirit in which it was given, and also at the same time to accept from them their best wishes for his future happiness. Mr. Bond was also requested to accept the gift of a tea service from the workmen for the bride-elect. Mr. Bond, acknowledging the gifts, said he would always remember the very great kindness of the employees by the splendid present they had just made to him. It was a hall-mark of their appreciation of himself, and of the great friendship which had ever existed between them. Of course, they would understand that his feelings on this occasion could not be very well expressed in words. He could only thank them, on behalf of his *fiancée* and himself, most sincerely for the excellent gifts which had been made and the kind words spoken. The members of the Gas Committee have also subscribed for a present to Mr. Bond, and a handsome rose bowl has been purchased; and we learn that a further present was to be made on behalf of the Crowlands officials and workmen.

DEZENDORF'S QUICK-TEST AUXILIARY DEVICE FOR GAS-METERS.

Last week reference was made in the editorial columns of the "JOURNAL" to an invention of Mr. R. L. Dezendorf, which was described and illustrated in our "Register of Patents" (p. 515). In view of the interest attaching to the arrangement, we reproduce the views of an American correspondent, who (in the light of his own experiences) has carefully considered the merits of the proposal. His opinions should be prefaced by the statement that no meter is fixed here without being officially tested and sealed; and all meters that will not pass the test within statutory limits, are rejected. Our correspondent writes:

The device is an invention of great importance and value to gas companies. In fact, under present conditions, it is a necessity, if there be a desire to reduce loss to a minimum and the many misunderstandings to which gas-supplying interests are exposed—particularly in the large centres.

The gas-meter, in all other respects perfect and accurate as human ingenuity can make it, has always lacked a very important feature—namely, means for positively and instantly making the tests that a gas company should be very particular to make, in order to protect itself against accident, loss, or complaint.

It is well known to many that the ordinary test-hand on consumers' meters is very unsatisfactory and imperfect for testing either meters or house pipes. Accounts are frequently opened and supplied through meters that do not register all the gas used. Furthermore, leak complaints and accidents have resulted from the unreliable and slow-moving test-hand which, being geared and necessarily subject to lost motion and slow moving, is a source of trouble, especially when tests are made, as must needs be, by the ordinary fitter or district man.

The invention will indicate in thirty seconds what it takes fifteen to thirty minutes to determine in the old way, when testing either the meter or the house-pipes. Therefore it is at once apparent if the meter does not register all the gas consumed; and the meter being found to register properly, the house-pipes can be tested in thirty seconds, instead of fifteen to thirty minutes.

The indicator is designed so that it may be placed where it is readily distinguished; and on a 5-light meter it will show gradations as fine as 1-600th part of a cubic foot. Being operated directly by the crank-shaft without gearing, it instantly shows any movement of the diaphragms, and will, therefore, without waste of time, indicate whether the meter registers correctly—there being no lost motion to take into account, or to cause error. It also makes it possible to determine the actual proof of the meter with the top on, as the revolution of the tangent can be pointed exactly with the revolution of the test-hand—a thing that was not possible until made so by this invention. Meters can also be tested on one, or any number of revolutions with the top on, and will afford a great saving in the testing of meters brought in from the district, and reduce the quantity of gas (or air) that is required for the test.

As the attachment provides a simple and reliable means for testing meters on the district, it will materially reduce the cost of making tests which experience teaches should be undertaken so as to keep meters on the district in reliable condition. Exchanging meters for age or length of service does not really afford proper protection against loss, as the period of accuracy varies according to the location and conditions where meters are set.

As much of the gas used is through one burner at a time, the loss where meters are not kept in good order is, of course, very considerable. Meters will frequently be slow on a consumption of 5 cubic feet per hour, and correct on 20 cubic feet.

The device makes it possible to carry out inspections quickly, economically, and positively, thereby admitting of greater length of service for meters where conditions are favourable, and a shorter period where the conditions are not so good.

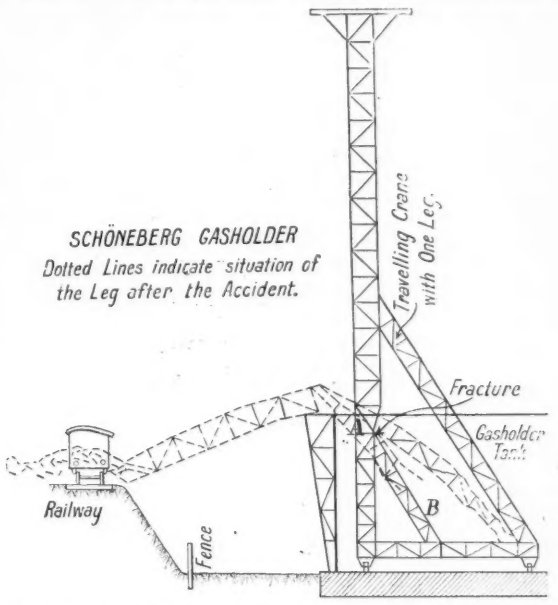
It is extremely important when unlocking and turning on a meter to first be certain that the meter registers properly; and it is very desirable if it does not register to know it positively and at once—a thing difficult with the ordinary test-hand.

Briefly, the advantages of this auxiliary indicator are as follows: 1. Meters can be unlocked and the meter and house-pipes properly tested with a very material saving of time. 2. Dangers from accidents from leaks are reduced by reason of the facility with which even the smallest is determined. 3. Tests on districts can be made when desired at a reduced cost and with accuracy. 4. Losses attributable to supplying gas through slow meters are prevented. 5. Misunderstandings growing out of comparisons caused by slow meters, and the complaints occasioned thereby, are materially reduced. 6. Unnecessary exchanging of meters on the district is prevented; for the facility with which the registration of the meter can be determined enables an examination on the district to be quickly and accurately made. 7. Meters may be tested and the actual test determined, as the revolution of the pointer and the tangent can be brought together, thereby eliminating the old doubt as to proof of a meter with the top on. 8. Meters with tops on can be proved on one or more revolutions of the tangent. 9. Saves expense incident to exchanging and testing and repairing meters reported in error through fault of the geared test-hand, besides materially reducing the cost of doing those things which should be done by a properly operated gas company. 10. Cannot wear out, or get out of order; is easily attached; and will prove of great economic value to gas companies.

THE ACCIDENT AT THE SCHÖNEBERG (BERLIN) GAS-WORKS.

In the last number of the "JOURNAL," brief reference was made to an accident which occurred on the 19th inst. at the Schöneberg Gas-Works of the Imperial Continental Gas Association in Berlin. A large girder crane, used in connection with the erection of a gasholder, gave way, and fell on to a train which was passing over the adjacent railway, cutting a truck in two, and injuring two persons. The tank and holder are being constructed by the Berlin Anhaltische-Maschinenbau-Actien-Gesellschaft. The tank is of steel, 200 feet in diameter and 51 ft. 6 in. deep; and the holder will have four lifts, and a capacity of 5,650,000 cubic feet. Immediately after the accident, Mr. E. Körting sent a telegram to the Secretary of the Association (Mr. R. W. Wilson), apprising him of it; and he subsequently sent a report, accompanied by a rough sketch showing how the girder gave way. These have been forwarded to us by Mr. Wilson; and we reproduce them. Mr. Körting's report is as follows.

"The tank of the new Schöneberg holder had been just finished, and was in preparation for the erection of the guide-framing. A big crane or leg, consisting of lattice work, was being put up, as shown on the accompanying sketch. This crane was movable on circular rails inside the tank; the necessary stability of the base being provided by oblique struts B. The leg was just erected to



its full height, and the top of it secured by one steel rope, while two others were to be added, as the midday rest set in, and the workmen came down. Shortly afterwards, when a rather strong wind was blowing, the construction gave way at the point A. The leg, after the break of the rope, bent slowly, and tumbled over the tank across the railway embankment just as a train passed. A truck was cut in two, one person severely hurt, and one or two others very slightly. I hear just now that the injured man is doing comparatively well.

"Whether the 'B.A.M.A.G.' is to be blamed, either in regard to the construction of the leg or for any negligence in erecting it, will be looked into by the authorities. At any rate, they have the full responsibility. Another question is whether, in the immediate neighbourhood of an immense railway traffic and a gas-works in action, one ought to permit the use of tools which, when going wrong, could do harm beyond the area allotted to the contractors as their field of action. The railway authorities and the Imperial Continental Gas Association, without releasing the 'B.A.M.A.G.' from their responsibility, will therefore have to insist on their adopting an absolute safe method of erection in future. Otherwise we do not incur any loss beyond the unavoidable delay, which, however, in this case, is without consequence."

Concrete Piles.—"The tremendous advance in the price of wood witnessed in recent years intensifies the interest otherwise felt by engineers in the concrete pile," says Mr. J. F. Springer, in "Cassier's Magazine" for September. "Concrete as a fully adequate substitute for wood is confidently recommended and accepted by hard-headed, practical men. Perhaps most engineers conversant with both would say that, upon the whole, concrete piling is to be regarded as decidedly preferable. It is not a necessity that these piles be for ever submerged. If the concrete, however, is to be subjected to the alternately freezing-and-thawing action of water, it must be made waterproof where so exposed. On account of the indifference of the concrete pile to hydraulic conditions, it often has even a first-cost superiority to the wooden one."

LONG DISTANCE BULK TRANSMISSION OF GAS.

A recent number of the "Journal für Gasbeleuchtung" contained a reprint of a communication made by Herr A. Lenze, of the engineering staff of the Düsseldorf Gas and Water Works, to the meeting of the Association of Gas, Electrical, and Water Engineers of the Rhine District and Westphalia, on the "Transmission of Gas through High-Pressure Mains to a Distance." The communication is largely of a theoretical character, and many of the tables given in connection with it cannot be usefully converted into terms of English measures. The following digest of the contents of the paper will, however, show the grounds it covers and the general conclusions at which the author arrives.

Coke-oven works have of late years made great efforts to utilize the gas produced from the ovens, not merely on the works itself, but, in so far as there is a surplus over and above that which can be profitably consumed there, in other directions also. In Westphalia, some towns and gas-works already take a certain amount of gas from the coke-oven works. These works, however, are at a considerable distance from some of the larger towns—such as Düsseldorf—and the question, therefore, naturally arises whether the gas-works of such a town could obtain the gas it requires wholly or partially from coke-works. The question may be advantageously investigated in a purely academical manner, in order to ascertain the relations which would have to be maintained between the diameters of the mains required, the initial gas pressure, and the quantities of gas transmitted. The power required and the cost of transmission may also be investigated. The coke-ovens are at a distance of about 50 kilometres (or, say, 30 miles) from Düsseldorf, and the author has calculated the quantity of gas which would be transmitted by mains of 100 to 500 mm. (say, 4 to 20 inches) internal diameter under absolute initial gas pressures of 15, 20, 35, 60, and 80 metres (49, 66, 115, 197, and 262 feet) head of water. His calculations were made according to a modification of Pole's formula introduced by W. Jäger, of Berlin, which when transposed into terms of English measures becomes approximately as follows:

$$Q = 957\, d^2 \sqrt{\frac{(h_i^2 - h_o^2) \times d}{s \times h_o \times l}}$$

in which

- Q = the volume of gas of specific gravity s issuing from the main in cubic feet per hour.
- h_i = the absolute initial pressure in inches of water.
- h_o = the absolute terminal pressure in inches of water.
- d = the diameter of the main in inches.
- l = the length of the main in yards.

For calculating the power required to drive the gas through the main, the author takes the following formula for isothermal compression:

$$N = \frac{10{,}000 \times p_1 \times l_n \frac{p_2}{p_1} \times Q}{3600 \times 75 \times \eta}$$

in which

- N = the number of horse power.
- l_n = the length of the main in metres.
- p_1 = the absolute pressure in front of the compressor.
- p_2 = the absolute pressure after the compressor.
- Q = the quantity of gas in cubic metres at the pressure p_1.
- η = the working efficiency (= 0·65).

Using these two formulæ, the author has calculated both the quantities of gas and the power required for the total length of main of 50 kilometres, and also the figures for half that length of main, with a view to ascertaining whether it is advantageous to introduce an intermediate pumping-station halfway along it. From these tabulated figures, it becomes evident that from the economical standpoint no good purpose is served by the introduction of an intermediate pumping-station. For instance, at 8 atmospheres pressure absolute 31,000 cubic feet of gas may be forced per hour through a main 100 mm. (about 4 inches) in diameter and 50 kilometres (54,680 yards) long, and the power required will be 107 H.P. In order, however, to force approximately the same quantity—viz., 32,700 cubic feet—through a main of the same diameter and half the length, 93 H.P. will be required; so that for transmitting this volume of gas through the total length of 50 kilometres of main 186 H.P. would be required if the pumping were done in two stages. Consequently, it appears that the employment of an intermediate station can only be justified if it is desired to avoid the evils of very high-pressure and the considerable rise of temperature which ensues when the pumping is done in one stage. It is not defensible on the ground of economical working pure and simple.

Another table given by the author shows the cost of compression per cubic metre of gas transmitted for absolute initial pressures of 20 metres (65·6 feet) and 80 metres (262·5 feet). As an example of the results shown in this table, it may be mentioned that the annual cost of transmitting gas through a 100 mm. (about 4 inches) main will be either £1532 or £2110, according as the absolute initial pressure is either 65·6 feet or 262·5 feet of water. On the other hand, if the quantity of gas transmitted is taken into account, the cost per 1000 cubic feet amounts to only 1·9d. at 262·5 feet pressure, as compared with 6·3d. at 65·6 feet pressure. These general calculations are interesting as affording an idea of the quantity of gas which can be transmitted for the expenditure of a given power and cost. But the further question as to the diameter of the main which is required for transmitting the particular quantity of gas to a stated distance may next be considered, in conjunction with the problem of the initial pressure or fall of pressure at which the installation can be most advantageously worked. This question has been worked out by the author for a particular case relating to the Düsseldorf Gas-Works.

It is contemplated erecting a gasholder of about 80,000 cubic metres (about 2,800,000 cubic feet) capacity in the district, at a distance of 5 kilometres (5468 yards) from the gas-works, and to work from it by means of governors directly into the distributing system of the town. If the gas stored in this holder is taken as about 70 per cent. of the maximum output per diem, there might be distributed from it about 110,000 cubic metres. Therefore this quantity of gas must be transmitted to it per diem; or, for a 20 hours' working day, there must be transmitted 5500 cubic metres (about 194,000 cubic feet) of gas per hour. The power for, and cost of, transmission has been calculated for all standard sizes of mains from 200 mm. (8 inches) to 700 mm. (28 inches), both for gas-engine and for electro-motor power. Steam power is here excluded for local reasons. The cost of gas for power is taken at 1s. 1·6d. per 1000 cubic feet, and the cost of current at 0·72d. per unit. The efficiency of the blower has been taken at from 50 per cent. for small to 65 per cent. for large sizes. Interest on the capital outlay has been reckoned at 4 per cent.; amortization at 1 per cent.; depreciation on buildings at 3 per cent.; on mains at 4 per cent.; and on the machinery at 10 per cent. The specific gravity of the gas, which contains some amount of water gas, has been taken at 0·44. The fall of pressure up to 1000 mm. of water (39·3 inches) has been taken according to Pole and for higher falls according to Jäger. The fall of pressure naturally increases as the main becomes narrower, slightly at first, but very greatly as the smaller diameters are reached. For instance, the fall of pressure, starting with 3 inches for a 28-inch main, becomes 6·4 inches for a 24-inch main, and rises to 800 inches for an 8-inch main. The power required naturally follows the same course. For instance, for the 28-inch main it is only 3½ H.P., but rises for a 12-inch main to 115 H.P., and for an 8-inch main to 355 H.P.

In calculating the power required, it is clear that at low pressures the work of compression is relatively small, and the total work can, therefore, be taken as equal to the work of transmission according to the formula:

$$N = \frac{Q \times H}{3600 \times 75 \times \eta}.$$

On the other hand, at high pressures the work of transmission is relatively low, and only the work of isothermal compression, calculated according to the formula already given, comes into account. These two methods of computing the work come together at between 1000 and 2000 mm. (39·3 and 78·6 inches) positive pressure. An endeavour has been made to ascertain the most favourable conditions in respect of the diameter of the main, and of the working power required for an installation, by calculating the figures for different sizes of main on the basis of figures for the cost of gas and current and capital charges already stated. With large mains the cost of pumping the gas is naturally low, but the capital charges are high. With small mains, where the power required for pumping is relatively high, electricity is costly compared with gas as a source of power. Taking both running cost and capital charges into account, it is found that for a main of 5 kilometres (5468 yards) in length delivering 5500 cubic metres (194,000 cubic feet) of gas per hour, the most economical size of main is about 500 mm., or (say) 20 inches diameter. With this size of main the electro-motor is cheaper than the gas-engine, because the power is not required at all during the spring, summer, and autumn, as the gasholder under consideration can then be bye-passed and the gas delivered direct from the gas-works to the distributing system. The higher working charges of the electro-motor in the winter months when it is in use are thus off-set by the smaller space it occupies as compared with the gas-engine, and the greater convenience in working.

The author concludes his communication with a comparison of the fall of pressure for different sizes of mains according to the formulæ of Pole, Jäger, Birkholz, and Fliegner respectively. A few figures may be given from this table, which refers to a length of main of 5 kilometres (5468 yards) passing 5500 cubic metres (194,000 cubic feet) of gas per hour.

Fall of Pressure According to Different Formulæ.

Diameter of Main. Inches.	Pole. Inches.	Jäger. Inches.	Birkholz. Inches.	Fliegner. Inches.
28	3·0	3·1	2·1	2·2
24	6·4	6·7	4·1	4·2
20	16·0	16·4	9·6	11·8
16	48·9	48·3	28·5	36·1
12	206	177	119	162
10	512	368	296	386
8	1563	812	904	1255

Jäger's formula gives figures greater than Pole's when the fall of pressure is less than 40 inches of water. For greater falls of pressure, Pole's formula gives results which are too unfavourable; and Herr Riedl has shown by experiments made at Crefeld that Birkholz's formula (which was based mainly upon observations on the Lubeck-Travemünde high-pressure main), is more nearly

correct for such conditions. Fliegner's formula (which was derived from exhaustive investigations on the main between the new gas-works on the Lake of Constance and the town of St. Gall), gives falls of pressure very similar to those of Birkholz, but rather more unfavourable, and at the higher falls of pressure approximating to the values given by Pole's formula. Unfortunately, it has not yet been established which formula should be applied in a given case, as all the formulæ are more or less empirical and apply to particular cases, but can lay no claim to general applicability. It is eminently desirable that as many and as exact experiments as possible should be made with existing high-pressure installations, so as to obtain clearer information on the fall of pressure in the transmission of gas under high pressure.

THE NAME OF THE PROPOSED "INTERNATIONAL CANDLE" UNIT.

[Communicated.]

In the "Memorandum" issued last May indicating agreement between America, France, and Great Britain as to a common unit of light, it was hoped the suggested name "International Candle" would be generally approved and obtain official international sanction. Whether objection be raised or otherwise to the unit as such, it would seem that its designation is not to pass without question. In the August number of the "Illuminating Engineer," M. Blondel contributes a short article on the subject, for the purpose of suggesting the advisability of having a common name for the agreed common unit of light. He appears to think that the expression "international candle" may lead to some confusion and trouble; and he gives his reasons. Dealing first of all with the word "candle," he points out that this is the name of a material object, and it is as unscientific to call the unit of intensity an "international candle" as it would be to call the unit of heat an "international stove." The prefix "international" is also objected to as being cumbersome, and too long either to write or to conveniently pronounce. It may therefore be dropped, with resulting confusion between this standard and other existing candle standards. The further fact that the names—"international candle" (I.C.), "bougie internationale" (B.I.), and "internationale kerze" (I.K.)—do not lend themselves to a common symbol, is given as a third reason of the inadequacy of the expression.

M. Blondel proposes the adoption of a new name, either the Greek "pyr" or "phos," or a scientist's name, such as "Violle." The latter would appear to be perferred, since the symbol "V" or "Vi" is suggested. Initially, in order to comply with the existing custom, each country could associate the name of the unit with the name of the material object actually employed, as, for instance, in "25 Viol candles" or "25 V. candles," much as the Germans now say "25 Hefner-Kerzen."

From the mere point of view of philological accuracy, there is something to be said against the use of the word "candle." It would seem, however, on the face of it, altogether inadvisable to drop, without very serious cause, a term which has become so universally known and understood. There are many words in all languages which have, in usage, lost their true etymological meaning, but nevertheless are found exceedingly useful; and if the word "candle" with its prefix does ultimately serve to denote intensity, the utility of the expression will be its best excuse.

The term in each of the countries concerned is a well-known one. Whatever its defects as a standard of comparison, or however much the several candles may differ, the candle has been the forerunner and the basis of most of the suggested and established primary standards. In England and in America, it will be remembered in its measure and derivative, the 10-candle pentane standard; in France the name has established itself in the bougie décimale, approximately one-tenth of the accepted carcel standard; and in Germany a candle unit, officially adopted in 1868, although supplanted by the Hefner in 1884, had at least found a place in the nomenclature of the lighting industry. The expression "candle" is, in fact, the only one which has at one time or another been international in character. It has stamped itself, so to speak, into photometrical language and literature, and by reason of its familiarity to technician and layman alike, and its usage in so much that has been printed and published, it would now be a pity to lose it. The word applied as a unit of light is exceedingly useful; since, while it is never likely to be confused with the material object, it both suggests its origin and is an understandable measure for the general public.

The writer cannot quite agree with M. Blondel that the prefix "international" is particularly inconvenient. It is a necessary expression to indicate agreement between the nations concerned, and gives the "candle" a distinctive title. For initial purposes, it cannot be considered more cumbersome than the suggested alternative "Viol candle." The prefix may ultimately be dropped in ordinary parlance; but the unit will, it is hoped, have so far further established itself that the photometrical term "candle" will be understood to mean the "international candle," and all other and less used candle standards—such as the sperm, or the paraffin—can be designated, as they should be, with their explanatory prefixes.

The question of a common symbol is more worthy of consideration; but there should be no great difficulty in the general adoption of some letter which all technicians, whom only it would concern, may readily recognize. M. Blondel points out that the terms "international candle," "bougie internationale" and "internationale kerze" yield dissimilar initial letters. He gives the derivation of the English "candle" as from the Latin *candela;* the French "bougie," from *chandelle de Bougie*, a city near Algiers; and the German "kerze" from the Latin *cerata* (French *cierge*). Although M. Blondel does not suggest this at all, it would seem that the initial letter "C" of the Latin roots would serve admirably for the common symbol of the proposed "international candle."

M. Blondel concludes his short note by suggesting that where measurement of spherical or hemispherical candle power is referred to, the sign ⏀ ⏁ or ⏂ should be added after the symbol. These signs differ from those proposed by the Zurich International Photometric Committee by the addition of a horizontal bar; and it must be agreed that the addition is likely to improve the distinctiveness of the signs.

EARLY DAYS OF GAS SUPPLY AT YARMOUTH.

There has lately been brought under our notice by Mr. Thomas Glover, of Norwich, an interesting document connected with the early days of gas supply in Great Yarmouth. It is dated Aug. 14, 1840, and is consequently just over 69 years old. The gas lighting of Great Yarmouth, as Mr. W. J. Carpenter, the present Engineer and General Manager of the Gas Company, told members of the Eastern Counties Association at their meeting in April, was inaugurated in 1824, when Mr. G. S. Palmer contracted with the Paving Commissioners to supply the town with what was then a new illuminant. Subsequently the Company was formed, and they seem to have done good business, and were desirous of extending it, for at the date of the circular they had just effected extensive improvements in their plant, whereby they were able to afford a more ample and uniform supply of gas; and they submitted to the inhabitants an amended scale of charges for different-sized burners, without meter, distinguishing the summer and winter quarters, and the charge per 1000 cubic feet if supplied by meter. The figures are so representative of the early system of supplying gas, and are in such striking contrast to that now general, that they are worth reproduction. The following are the quarterly charges on the "per burner" system.

Summer Quarters.

Description of Burners.	Six Days per Week.			
	Nine o'Clock.	Ten o'Clock.	Eleven o'Clock.	For every Extra Hour.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Argand, 14 jets . .	0 9 6	0 11 6	0 14 0	0 2 6
,, 10 ,, . .	0 7 6	0 9 6	0 11 6	0 2 0
Cockspur	0 6 3	0 8 0	0 9 9	0 1 9
	Seven Days per Week.			
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Argand, 14 jets . .	0 10 6	0 13 6	0 16 6	0 3 0
,, 10 ,, . .	0 8 9	0 11 1	0 13 5	0 2 4
Cockspur	0 7 3	0 9 3	0 11 3	0 2 0

Hall-light, until bedtime, £4 per annum, or 10s. per summer quarter.

Winter Quarters.

Description of Burners.	Six Days per Week.			
	Nine o'Clock.	Ten o'Clock.	Eleven o'Clock.	For every Extra Hour.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Large argand . . .	1 8 6	1 14 6	2 2 0	0 7 6
Small ,, . . .	1 2 6	1 8 6	1 14 6	0 6 0
Cockspur	0 18 9	1 4 0	1 9 3	0 5 3
	Seven Days per Week.			
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Large argand . . .	1 11 6	2 0 6	2 9 6	0 9 0
Small ,, . . .	1 6 3	1 13 2	2 0 3	0 7 0
Cockspur	1 1 9	1 7 9	1 13 9	0 6 0

Hall-light, until bedtime, £4 per annum, or £1 10s. per winter quarter.
Charge per meter, 10s. per 1000 cubic feet.

The following were the regulations to be observed and the conditions on which gas would be supplied.

1.—Places of public religious worship, manufactories, dye-houses, inns, public-houses, warehouses, fish-houses, dwelling-houses, and all places where the time of burning is irregular, supplied by meter only.

2.—The meters are furnished by the Company at prime cost or on a rent charge, a scale of which is at the office of the Company.

3.—All rents by burners to be paid in advance quarterly, and all rents by meter to be paid quarterly, within fourteen days from the expiration of the quarter.

4.—All consumers not using meters are supplied with burners by the Company, and no other burners can be allowed to be used.

5.—Consumers paying by burner are not allowed to use any other kind than those named in the foregoing scale, nor to change the number or description, except at quarter-day; and a written notice must be previously delivered at the office of the Company, stating the nature of the intended alteration.

6.—No argand burner to be used without a glass where a meter is not used, or one-fifth more will be charged.

7.—No extra charge will be made if the light be extinguished within one quarter-of-an-hour of the time contracted for, and one hour extra is allowed on Saturday nights.

8.—The Company recommend straight chimney glasses; the gas burning more steadily in them. If too large a flame be attempted to be produced, the light will be injured both in cleanliness and brilliancy, and a quantity of unconsumed gas and carbon pass off, to the injury of the Company, to the consumers at large, and to the annoyance of the party so burning the gas.

9.—Persons wishing street or other lights, which cannot be supplied by measure, must make a specific agreement with the Company; and all persons taking the gas are expected to enter into a contract or agreement, stating the terms on which they are to be supplied.

10.—The fittings and services from the Company's main must be paid for by the consumer; and the Company will supply them as moderately as possible, under the superintendence of their foreman.

11.—All persons wishing to be supplied with gas are requested to apply to the Collector or at the Company's works.

12.—Experience has placed beyond the least doubt that a coke fire, for domestic or other purposes, is the most economical that can be used; but there is an advantage of much greater importance, as it tends to augment the comforts of the poor, by enabling them to have a cheerful fireside for about half the price of coals. The coals now used at the gas-works produce a quality of coke quite equal to that made for the express purpose of the maltsters, and is offered for sale at an extremely moderate rate, and with a diminution in price if taken in large quantities.

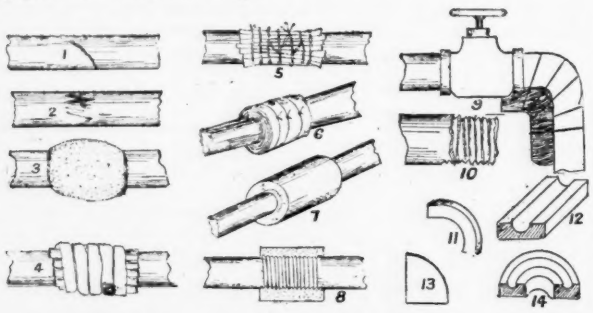
13.—Any deviation from the above regulations and conditions will oblige the Company to discontinue the supply, and the charges which the consumer may have paid in advance will become forfeited.

14.—The charges of the Company having been reduced, no discount will in future be allowed.

PIPE REPAIRING IN EMERGENCIES.

A recent number of the "American Gaslight Journal" contained the following communicated article on this subject.

Several different methods of quickly repairing leaks in gas-pipes may be classed under various heads. There are the shrinking-on descriptions, the splint system, the bonding class, the wrapping method and others. These classes of emergency pipe repairing were formulated by the automobile people, who found it necessary to utilize emergency repairing schemes for leaks and breaks in gas-engine pipes. The gas-engine machinists were not long in adopting classifications of pipe wrapping and bonding to make a split or cracked pipe do service until such time as a new joint might be put in. The gas engineering fraternity have adopted some of the types of emergency leak repairs for ordinary house gas-pipe service. Hence, in the annexed illustrations are shown some of the plans utilized for closing gaps and making defective pipes last a little time longer.



The types of fractures may be placed under two general heads, illustrated in figs. 1 and 2. The break in the pipe may be straight or diagonally across, as in the first diagram; it may be a ragged, dove-tailed break, as in the second; or the leak may be due to a pinhole, or to the fact that, the pipe having been crushed, the collapsing of it resulted in developing leaky places. Again, the trouble may be at a leaded union, or the packing may be worn or imperfect. The various kinds of defects have to be taken into consideration. Of course, the first move involves placing the ends together, and, if possible, putting a jacket on, or other means adopted to retain the alignment of the broken ends. Clay is used to close the joint, if other material is not at hand, and cork wrapping has been employed in cases with good results. Cork can be bought in strips and be wound about the joint, which should then be bound up with wire. The workman can bunch-up the cork, as shown in fig. 3, and wind it, or he can adopt the splint method, as in fig. 4, which consists in putting thin pieces of wood about the fracture, and binding up with tape or cord. The wood pieces are packed with clay or lead, and a wrapping of tape wire adds to the security. Another method of this class is shown in fig. 5. Strips of cork can be used advantageously for the splints. Sometimes pieces of leather or rubber are employed.

The common fabrical wrapping system is shown in fig. 6. The broken ends of the pipe are properly adjusted; then cotton cloth, or strips from an old blanket or gunny sacking, are wound securely round the closed union, thickness after thickness, until a shoulder is made. Then the whole combination is wound with wire to make it solid. The process of shrinking on a section of metal sleeve, as in fig. 7, is used in some shops. The piece which is shrunk on often consists of piping the next size larger in diameter than the original. Then, again, a piece of metal is bored out to fit over the pipe ends, when, after the sleeve is on, the pieces are brazed so as to effect a tight joint. The threaded-end system of uniting two broken ends requires more mechanical work than most men desire to put into an emergency job. The broken ends having first been made square, they are each cut with a thread, and a sleeve similarly threaded is turned on, as shown in fig. 8. This type of closed fracture is quite permanent in its nature.

In some shops there are an assortment of wooden and metal forms for use as supporting braces or brackets for fractures in curves. In fig. 9, for example, the turn in the pipe is broken. It being impracticable to set the fracture and retain it in a fixed order without properly formed supports, the supporting brace shown in the shaded part is made of hard wood and applied. The hard-wood form should be cut to the shape of the broken union, then the form can be put in position, and the piping wired fast to it as illustrated. Of course, there are men who carelessly undertake to make a leaking threaded union secure by simply winding some twine or cotton thread between the cut threads of the pipe end, as shown in fig. 10. The threads fill up a void, and make a loose union more secure by causing the threads to cling tighter; but it is a slipshod manner of doing work, and cannot be encouraged.

In regard to the types of forms of hard wood and metal which may be carried in stock for affording means for gripping on pipe turns, the next figures exhibit specimens. The style shown in fig. 11 can be fitted under a curved pipe and wound into position with wire, cord, or tape. Fig. 12 is a common base with a groove for the pipe. Fig. 13 shows the block form necessary in giving an underneath support to certain turns of pipes. Then there is the half-turn block, as in fig. 14, made so that a section of pipe making a turn can be accommodated with a grooved resting-base.

Temperature of the Bunsen Flame.

The "Journal für Gasbeleuchtung" quotes a report of the German Physical Society on researches made by Herr H. Schmidt, of the Physical Institute of the University of Berlin, on the laws of radiation of the bunsen flame. On the basis of the laws of pure temperature radiation, he ascertained the temperature of the bunsen flame from emission and from absorption. Optical-pyrometric determinations of emissivity gave a temperature of about 1600° C. in the middle, and of about 1800° C. at the edge of the flame, with a mean temperature of about 1640° C. From the absorptive power of the flame, a mean temperature of 1630° to 1695° C. was found—the most probable figure being 1670° C. The two values of 1640° and 1670° C. found by the two different methods, therefore, agree very well.

Recent Wills.—Mr. William Andrew M'Intosh Valon, of The Lodge, Kennington, Ashford, and of Caxton House, Westminster, whose death was recorded in the "JOURNAL" for the 6th ult., left estate of the gross value of £21,186, with net personalty £17,964. Testator bequeathed, on the death of his widow, £500 to his Secretary, Mr. W. H. Vince. Mr. John Marsland who was for some years the Manager of the Sowerby Bridge Gas-Works, left estate valued at £11,019. The late Mr. A. G. Sutherland, Director of the Sutherland Meter Company, whose death, under painful circumstances, was recorded in the "JOURNAL" for the 15th of June, left estate of the gross value of £12,228. Alderman Richard Williams, J.P., of Wednesbury, at one time a Director of the South Staffordshire Water Company, left estate valued at £32,388 gross, with net personalty £30,090.

Liquid Gas in Switzerland.—The production of liquid gas at Bassersdorf, Switzerland, for heating, lighting, and similar uses, has passed beyond the experimental stage, according to a recent United States consular report from Zurich. The liquid gas is obtained by the distilling of raw petroleum and of bye-products of the lignite and oil industries. Its prime cost is stated to be no greater than that of any other kind of gas produced in small plants. It is easily transportable; it is non-poisonous and three times less explosive than coal gas; and it has a high illuminating and heating power. It is stated that the installation costs are low, and the manipulation is simple and without danger. Gases not liquefied are employed in the working of the factory. The gas has been used in more than a hundred installations in Switzerland, all of which are declared to be entirely satisfactory to the purchasers in their operating results.

FURTHER STUDIES IN COAL CARBONIZATION.

In the notice of the last Annual Report of Mr. R. Forbes Carpenter, the Chief Inspector under the Alkali Works Regulation Act, 1906, which appeared in the "JOURNAL" for the 15th of June (p. 707), reference was made to the further studies in coal carbonization which had been carried out under Mr. Carpenter's supervision during the year. The crowded state of our columns at the time only allowed of an indication being given of the nature of these researches; but, in view of their importance, we now reproduce this portion of the report.

INTRODUCTORY.

In the course of remarks made last year on the special features presented by some of the products resulting from the distillation of coal in continuous and intermittent vertical retorts,* attention was directed especially to ammonia and hydrocyanic acid, and to the proportionate relationship between these bodies in the liquors resulting from the cooling, condensing, and washing processes to which the gases are subjected on leaving the retorts. These proportions were found to vary with the method of retorting as well as with the nature of the coal carbonized. It was also stated that, in addition to the generally accepted hypothesis for the formation of hydrocyanic acid at the expense of ammonia already existing, by the latter meeting with highly incandescent carbon on its way out of the retort, a possible alternative hypothesis had been brought to my notice, of its formation by the reaction of ammonia on marsh gas at the temperatures obtaining in the retort. This was deemed a subject worthy of investigation; it being thought possible that incandescent carbon might play the part of a catalyte at a temperature below that at which it is itself competent to take its own active part in the reaction.

The record of experiments conducted by Dr. F. Bergmann, at the suggestion of Dr. Bunte, at Carlsruhe in 1896,† was studied, as also the later results, conflicting in many respects with the above, of experiments by Denis Lance in the "Comptes Rendus" (124), as preliminaries to consideration of fresh experimental work in my own laboratory. It was felt that only by limiting variation of conditions in the experiments, as far as possible, to one at a time, of the factors entering into the reaction could any two experiments be usefully compared. The failure to observe this precaution had vitiated the certainty of many of the conclusions drawn by Dr. Bergmann from his own research.

It was decided, therefore, to aim at beginning with the simplest conditions that could be devised; working with mixtures of marsh gas and ammonia at temperatures comparatively low, and with a neutral substance as catalyte that it was thought would undergo no chemical change at the temperature chosen. Provision was made for measurement of the outgoing gases as well as those entering as an essential feature in the scheme of work, so that balance-sheets could be prepared from the analyses made.

So many difficulties of various kinds, however, arose from employing specially prepared marsh gas, that coal gas deprived of its illuminants by fuming sulphuric acid was employed in the rest of the research. In only two of the completed experiments here recorded did marsh gas of special preparation take part. The results of these are given in Table VA., experiments Nos. 15 and 18. The maximum purity obtained was 86·3 per cent. marsh gas, the balance of the amount not used in No. 15 being utilized in No. 18, being made up to the volume required by addition of coal gas deprived of illuminants, as above stated.

The researches of Professor Bone—especially those presented by Messrs. Bone and Coward to the Chemical Society in 1908—have been of great value in indicating at what temperature methane itself begins to undergo decomposition by heat in presence of porcelain. The amount of such decomposition is stated to be insignificant below 800° C. for pure methane in porcelain tubes, even when packed with quicklime to give increase of surface. This was confirmed here for the diluted methane employed (*cf.* experiments Nos. 4, 7, and 8). Moreover, when higher temperatures (985°-1015° C.) were employed, the authors state: "The use of porous porcelain for this purpose was found to be inadmissible, owing to the readiness with which it is attacked and reduced by the methane (or possibly by the carbon deposited from methane) at this temperature." They further go on to state: "How strong this reducing action is may be gathered from the fact that in one experiment, in which the tube was packed with this material, the gases contained no less than 10·5 per cent. of carbon monoxide after 30 minutes, and 22·5 per cent. after 60 minutes (nitrogen = 0·7 per cent. only)." For this reason, porcelain as contact material was replaced in the authors' researches by quicklime, when after 60 minutes' contact and circulation the gases contained only 2·8 per cent. of carbon monoxide. The authors used the method devised by Messrs. Bone and Wheeler, of continuous circulation of the gases under study; the whole apparatus constituting a closed circuit.

Confirmation of these facts was obtained here in the later researches at higher temperatures; but still not so high as those named by Messrs. Bone and Coward. When the temperature exceeded 800° C. in the experiments conducted here, a marked darkening was noticed of the broken porcelain to grey, due to slight deposition of both iron and carbon from the gas. Up to that temperature, such alteration in colour was slight. Before commencing research on the mixture of methane and ammonia, it was necessary to ascertain the behaviour of methane (here and subsequently the coal gas deprived of illuminants is always to be understood) at different temperatures, comparatively low—700°–800° C.—in presence (*a*) of the neutral contact substance porcelain, and (*b*) of the possibly active substance carbon in the form of wood charcoal, before proceeding to the more complex problem presented by the reactions where two decomposable gases were involved at temperatures of higher grade (830°–930° C.). The exigencies also caused by inability to obtain a temperature of 800°–810° C. at will with an Erlenmeyer furnace dictated this course. Subsequently a 10-burner Méker furnace was used, with which all the later and all higher temperature work was done.

The work opened out as it proceeded. The influence of moisture on the decomposition of methane in presence of carbon was found to be a subject on which knowledge had to be gained; so that the experiments had to include comparison of dry and moist methane upon porcelain and carbon respectively. Those on dry dilute methane, though not coming first in order of time, are presented in Tables IA. and IB. In the latter of these a methane balance is presented. The variables here are temperature and contact substance; amounts of gas passed and rates of flow being approximately constant. Table IB. summarizes quantitatively the results of Table IA., and brings into prominence the salient points to be grasped.

The results of similar treatment of diluted methane saturated with aqueous vapour at different temperatures, and the behaviour of the same two contact substances, are presented in Tables IIA. and IIB.; the latter table equally acting as a quantitative summary to the former. It will be noticed that the yield of ammonia finds record in the wood charcoal experiments only in Table IB.—see "Conclusions" following. It is presented for both contact substances in Table IIB.; hydrocyanic acid only making its appearance at the higher temperature obtained later with the Méker furnace.

Results of these (wood charcoal) contact experiments—those at 935° C. being the latest in order of time, and made with all the experience gained during the research—are presented in Tables III. (A and B) and IV. The variable in the experiments at 935° C. is "rate of flow," other conditions being kept as constant as possible. In Table IIIB., a methane balance is also presented, and hydrocyanic acid appears for the first time.

APPLICATION OF EXPERIMENTS TO GAS-WORKS OPERATIONS.

It is manifest, from consideration of these seven tables, that in applying the knowledge of the facts ascertained to large-scale operations in gas-works and coke-ovens, the consideration of what is described here as "rate of flow" has an enormous influence on the products obtained in coal carbonizing. Temperature is by no means the only factor of importance. This is also emphasized by Professor Bone*. When it is considered that the raw material dealt with in these experiments is the ultimate product of high-temperature, but also of high-speed, carbonization—purified, of course, for domestic consumption—an idea of the importance of realizing what is possible to happen in the retort is gained. Perhaps the nearest large-scale results to which I am enabled to point as to rate of flow and its effect on methane were contained in Mr. Short's paper quoted last year, where in the coke-oven tested the percentage of methane fell from 23 to 4 within the last five hours. Of course, here the central area, a principal channel for the escaping gases, was in this period rapidly rising to coking temperature.

INTERACTION OF METHANE AND AMMONIA.

Having stated results of the simpler problems presented for study, I proceed to consider the more intricate and complex conditions surrounding the next portion of the subject—the inter-action of methane and ammonia. Here the volumes of gas dealt with were larger, not only by reason of the presence of ammonia, but on account of the necessity of employing a large volume of coal gas deprived of illuminants as protecting diluent; also a fair proportion of the latter was required for sweeping forward products of reaction when the supply of ammonia was cut off. This latter, it will be seen, amounted to from 444 c.c. to 510 c.c. in each experiment; in only one instance (Table VIA., experiment No. 21) did this volume markedly fall below 400 c.c. In manipulating the apparatus to ensure delivery of correct proportions of methane and ammonia, the two bodies whose action was to be studied, in a steady continuous stream over the whole period of trial, much vigilance had to be exercised. The disturbing influence of varying increase of volume in the outgoing gases had also to be provided for, so that rates of flow in the experiments, with the best endeavours to keep this factor constant, were found to vary more than could have been wished when the results came to be calculated out. On the other hand, as great uniformity as could be looked for in this respect characterizes the rates of flow recorded in Tables IA. and IIA.

In Tables VA. and VIA., results are grouped according to rates of flow designated as "slow" and "rapid;" but these terms only apply relatively to the conditions laid down for the experiments as conducted in the laboratory with the apparatus and assistance at command. In Table VA. are grouped the experiments at varying temperatures and on the two contact substances at slow

* See "JOURNAL," Vol. CIII., p. 112. † *Ibid.*, Vol. LXVII., p. 1032.

* See "JOURNAL," Vol. CIII., p. 321.

TABLE IA.—*Action of Porcelain and Wood Charcoal on Dry Coal Gas.*

0° C., 760 mm.	Porcelain. 230 c.c., 200 Grammes.								Wood Charcoal. 230 c.c., 68 Grammes.			
	White.		Grey.		Dark Grey.		Dark Grey.					
	900° C.		860° C.		870° C.		770° C.		735° C.		835° C.	
	Entering.	Leaving.	Entering.	Leaving.	Entering.	Leaving.	Entering.	Leaving.	Entering.	Leaving.	Entering.	Leaving.
Experiment No.	1		2		3		4		5		6	
Coal gas used c.c.	2395	3115	2340	2865	2360	3015	2400	2485	2305	2700	2300	2860
Per 100 volumes—												
CO_2	0·1	0·2	0·1	0·1	0·1	..	0·1	0·4	0·1	0·6	0·1	0·4
O	0·4	0·1	0 6	..	1 0	..	0·6	..	0·6	0 1	1·2	..
CO	13·6	18·9	13·1	14·8	12·6	14·7	17·1	16·5	15·6	13·5	16·9	13·5
CH_4	30·5	11·6	31 7	11·9	31·8	8·6	28·5	28 0	29·3	14·4	28·1	8·6
H	49·8	62·6	52·7	68·4	49·0	70·6	49·6	51·1	50·5	64·7	47·7	70·9
N	5·6	6·6	1·8	4·8	5·5	6·1	4·1	4·0	3 9	6·7	6·0	6·6
	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Duration of experiment, minutes	63	..	64	..	60	..	59	..	59	..	61	..
Rate of flow . . c.c. per minute	38	..	37	..	39	..	41	..	39	..	38	..
Increase in volume, per cent. of gas entering	..	30·1	..	22·4	..	27·8	..	3·5	..	17·1	..	24·4
Gas in tube . . . . minutes	2·6	..	2·7	..	2·5	..	2·4	..	2·0	..	2·1	..

TABLE IB.—*Distribution of Products. Dry Methane.*

—	Porcelain.				Wood Charcoal.	
	White.	Grey.	Dark Grey.	Dark Grey.		
	900° C.	860° C.	870° C.	770° C.	715° C.	835° C.
Experiment No.	1	2	3	4	5	6
Methane balance—						
CH_4 entering, calculated as carbon grammes	0·393	0·398	0·403	0·367	0·364	0·348
Products per cent.—						
CH_4 undecomposed	49·4	46·0	34·7	101·9	57·4	38·0
Oxidized to CO_2	0·5	0·3	*Nil*	0·8	2·2	1·1
Oxidized to CO	36·1 } 36·6	15·8 } 16·1	19·1 } 19·1	*Nil* } 0·8	0·8 } 3·0	*Nil* } 1 1
As hydrocyanic acid	..	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*
As solid carbon (by difference)	14·0	37 9	46·2	−2 7	39·6	60·9
	100·0	100·0	100·0	100·0	100·0	100·0
Ammonia obtained . gramme	..	..	..	..	0·003	0·004

rate of flow; while in Table VIA. are presented experiments at varying temperatures and at rapid rate of flow on wood charcoal only as contact substance. At this stage in the research, it was thought of more importance to bring such of the conditions as were under control into as close harmony as possible with those existing in a coal-carbonizing retort, without attempting in any way to reproduce these on a laboratory scale. In Tables VB. and VIB. are presented, in summary form, the most important of the results obtained under these conditions. Distribution of products, both *qua* decomposition of ammonia and of methane, are presented in percentage form.

While in Table VB. in experiments Nos. 14 and 15, with porcelain as the contact substance, the ammonia balance shows distinctly the genesis of hydrocyanic acid at 780° C. and 800° C. at slow rate of flow, no evidence was obtained with wood charcoal as the contact substance, under the same conditions *qua* rate of flow, till 805° C. was reached. On pushing the temperature to a maximum 930° C. (experiment No. 20) and diminishing the rate of flow to a minimum, instead of getting, as anticipated, a marked yield of hydrocyanic acid, there was only a trace. The bulk of the ammonia also was decomposed. The results presented in Table VIB. show how the research was then pursued. First the rate of flow was tripled as compared with experiment No. 20. Unfortunately, *qua* temperature, intended to be kept constant, the maximum of 930° C. was not obtainable when No. 23 was run; but the yield of hydrocyanic acid increased practically up to the maximum attained up to that point.

The proportion of ammonia decomposed—two-thirds at 930° C. (No. 20)—suggested that, by slightly lowering the temperature, a still further yield of hydrocyanic acid might be looked for. The results followed expectation. Experiment No. 22 shows 19·7 per cent. of the nitrogen in the ammonia appearing as hydrocyanic acid in the outlet gases. On dropping the temperature still lower, the rate of flow being the same, it will be seen (No. 21) that while the ammonia decomposed dropped to 6·2 per cent., the hydrocyanic acid figure fell also approximately to that obtained subsequently in No. 19. The critical point of formation of hydrocyanic acid from ammonia in presence of methane appears, therefore, to lie at or slightly below 800° C. with both the contact substances tried, and at very varying rates of flow. No opinion is expressed as to the probable course of reaction—whether hydrocarbons other than methane (*e.g.*, ethane) first decompose, and ammonia reacts on the bodies of fugitive existence mentioned by Professor Bone in his paper already referred to, or whether reaction is preferably on separated carbon derived either from the methane or the wood charcoal employed as contact material.

Finally, attention is directed to Table IIIB. presenting results of an experiment (No. 11) conducted on a methane mixture containing hydrocyanic acid without addition of ammonia, to ascertain the stability of this body under conditions similar as regards temperature and rate of flow to others recorded in this series (*cf.* experiments Nos. 16 and 20) where ammonia was originally present, but was largely destroyed in the course of transit through the experimental tube. One of the contentions of Denis Lance, in opposition to Dr. Bergmann, was that hydrocyanic acid, formed either from its elements or by decomposition of ammonia, always appeared at the finish as ammonium cyanide. The experiments above alluded to (Nos. 16 and 20) seemed to point to Lance's conclusion as possibly correct, and No. 11 was designed to ascertain if nitrogen as ammonia in excess of nitrogen equivalent as hydrocyanic acid was essential to the existence of the latter under the conditions of the experiment. In the result, more hydrocyanic acid appeared at the outlet than entered; pointing to formation of hydrocyanic acid from gaseous elements and carbon having taken place. The possibility of this was confirmed in further experiments, Nos. 12 and 13, Table IIIA., conducted at the same temperature as No. 11.

APPLICATION TO VERTICAL RETORTS.

Again endeavouring to translate results and apply them to large-scale conditions, in the continuous vertical retort a zone of maximum and continuous heat exists perhaps at about three-fifths of the depth of the retort, measuring from the top. Here the coal has thoroughly coked, the horizontal section will, under normal condition, be well filled with incandescent solid, with absence of any central gas channel such as characterizes the horizontal section of an intermittent vertical retort. Here also the gas pressure, small as this is on the continuous vertical retort, will be at a maximum, while the rate of flow of gas from its diminishing evolution will be much lessened as compared with higher zones in the retort—conditions all favouring decomposition of methane and any accompanying ammonia, and formation of hydrocyanic acid from its elements. It is in this zone also, and somewhat lower, that it seems reasonable to look for formation of ammonia, if the reactions of hydrogen on the nitrogen existing in the coal still not completely carbonized have any actual existence,* since the ammonia, if formed, has better chance of survival in the higher zones of the retort. The suggested introduction of blue water gas at the base of the retort has not yet been experimentally effected, owing to the exigencies of other prior claims in the pioneer plant at Poole.

* *Cf.* Forty-Fourth Annual Report, pp. 71, 72.

TABLE IIA.—*Action of Porcelain and Wood Charcoal on Moist Coal Gas.*

0° C. 670 mm.	Porcelain (Light Grey). 310 c.c., 270 Grammes.				Wood Charcoal. 270 c.c., 80 Grammes.					
	Coal Gas Saturated with Moisture at				Coal Gas, Saturated with Moisture at					
	21° C.		50° C.		Dry.		50° C.		70° C.	
	765° C.		715° C.		735° C.		745° C.		720° C.	
	Entering.	Leaving.	Entering.	Leaving.	Entering.	Leaving.	Entering.	Leaving.	Entering.	Leaving.
Experiment No.	7		8		5		9		10	
Coal gas used (dry) c.c.	1920	1935	2315	2300	2305	2700	2300	2950	2305	2805
Per 100 volumes—										
CO_2	0·3	0·8	0·1	0·3	0·1	0·6	0·2	1·0	0·1	0·8
O	0·7	0·1	1·0	0·2	0·6	0·1	1·0	0·1	0·9	0·3
CO	12·1	12·0	14·1	14·2	15·6	13·5	14·1	14·9	14·2	14·7
CH_4	31·0	30·2	30·6	29·5	29·3	14·4	30·0	12·2	29·4	12·9
H	50·5	51·1	46·2	48·2	50·5	64·7	49·0	64·8	50·3	64·7
N	5·4	5·8	8 0	7·6	3·9	6·7	5·7	7 0	5·1	6·6
	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Aqueous vapour c.c.	48	..	319	..	*Nil*	..	316	..	1020	..
Duration of experiment minutes	45	..	57	..	59	..	60	..	61	..
Rate of flow (moist gas) c.c. per minute	44	..	46	..	39	..	44	..	55	..
Increase in volume . . per cent. of dry gas entering	..	0·8	..	0·5	..	17·3	..	28·7	..	22·1
Gas in tube minutes	3·1	..	2·9	..	2·4	..	2·1	..	1·7	..

TABLE IIB.—*Distribution of Products. Moist Methane.*

	Porcelain (Light Grey).		Wood Charcoal.		
	Coal Gas, Saturated with Moisture at		Coal Gas, Saturated with Moisture at		
	21° C.	50° C.	Dry.	50° C.	70° C.
	763° C.	715° C.	735° C.	745° C.	721° C.
Experiment No.	7	8	5	9	10
Aqueous vapour gramme	0·038	0·257	*Nil*	0·255	0·821
Methane balance—					
CH_4 entering, calculated as carbon . . gramme	0·320	0·381	0·364	0·371	0·365
Products, per cent.—					
CH_4 undecomposed	98·2	95·8	57·4	52·3	53·2
Oxidized to CO_2	1·5	0·8	2·2	3·5	3·0
Oxidized to CO			0·8 3·0	16·7 20 2	12·6 15·6
As hydrocyanic acid	..	*Nil*	*Nil*	*Nil*	*Nil*
As solid carbon (by difference)	0·3	3·4	39·6	27·5	31·2
	100·0	100 0	100·0	100·0	100·0
Ammonia obtained gramme	0·001	0·002	0·003	0·008	0·005

In the course of the many months that have elapsed since these experiments were commenced, my attention was directed by Dr. Harold Colman to the report of a research undertaken at Carlsruhe by Messrs. Mayer and Altmeyer* on the equilibrium between methane, hydrogen, and carbon. Their experiments were conducted on pure methane specially prepared from aluminium carbide, purified first by copper oxide, then soda, and finally concentrated sulphuric acid. The contact substances in their reaction were nickel and cobalt, reduced *in situ* by hydrogen, and deposited as a thin film on fragments of porcelain. These contact substances they regard as catalytic agents which do not affect the final equilibrium, but simply cause this to be attained more rapidly. The rate of flow through the reaction-tube—a U-tube heated in a molten lead bath—was only at the rate of two to three bubbles of gas per minute. Under these conditions, they state that methane suffers notable decomposition, and at an increasingly rapid rate, to carbon and hydrogen between 400° C. and 600° C. Their paper includes a diagram on which a curve is plotted showing the relative proportion of methane and hydrogen at temperatures ranging from 250° C. to 850° C. I understand that the curve is not accepted as accurate for the higher range of temperatures by other observers and students engaged also in this research (working, moreover, by different methods), as it does not accord with observed facts.

It will be seen from Mr. Linder's memorandum that Messrs. Mayer and Altmeyer's conclusions cannot be tested by the results set out in the tables, since the presence of hydrocarbons other than methane in the coal gas when deprived of illuminants, both before and after passing the reaction-tube, may well be surmised as probable; indeed, the relationship of hydrogen to the carbon balance showed in many cases that methane was not the only hydrocarbon present, though the carbon present was returned as such. Under the circumstances, no other course was possible.

I have requested Mr. Linder to prepare a short account of the apparatus used, the procedure, methods observed in calculations for presenting results, and analytical notes on the tables that follow his remarks.

* *Vide* "Berichte," 1907, pp. 40, 2134; also "JOURNAL," Vol. XCVIII., pp. 27, 157.

APPARATUS AND PROCEDURE.

(1) *Train of Scrubbing Cylinders to Purify the Coal Gas Employed from* (*a*) carbon dioxide, by soda lime and caustic soda; (*b*) hydrocyanic acid, by soda lime and caustic soda; and (*c*) ammonia, illuminants, and nitrogenous bases—pumice moistened with fuming sulphuric acid. [*Note.*—No special treatment was applied to remove "sulphur compounds," as it was unnecessary to take account in the analysis of the traces of sulphuretted hydrogen formed therefrom in the furnace tube and absorbed in the soda catch on the exit gases. Such sulphide was removed by shaking with lead carbonate before estimation of the cyanide.] This purified coal gas, stored over water in a bolt-head flask, was alone used throughout the experiments, with two exceptions, Nos. 15 and 18, already referred to; and the expression "coal gas" throughout must be taken as denoting the purified product.

(2) *Coal Gas Reservoir.*—A 13-litre bolt-head flask with paper scale calibrated throughout. The mouth was closed with a thick rubber bung, provided with suitable connections to enable the flask to be filled as required with purified coal gas and placed in connection, by means of pressure tubing, with water-gauge and mixing-flask. The bung was also fitted with a thermometer adjustable at any desired height. The various fittings made it possible to adjust the pressure of the gas at any desired moment, either for the purpose of measurement or the control of the gaseous current through the furnace tube.

(3) *Mixing-Flask.*—A 250 c.c. distilling flask, in a water bath, and placed in connection by pressure tubing with coal gas reservoir, ammonia (or hydrocyanic acid) cylinder, and furnace tube. The mixing-flask served to fulfil the following functions: (*a*) When dry coal gas was under experiment (Tables IA. and IB.), the flask contained 100 c.c. of strong sulphuric acid, through which the inflowing coal gas was allowed to bubble on its way to a drying-tube filled with pumice moistened with acid, by means of which final traces of aqueous vapour were removed before the gas entered the furnace tube. (*b*) When moist coal gas was in use (Tables IIA. and IIB.), the flask contained 100 c.c. of distilled water maintained at the desired saturation temperature by means of a water bath. (*c*) When the ammonia (or hydrocyanic acid) cylinder was in use (Tables III., V., and VI.), the empty flask served as a mixer for coal gas and ammonia (or hydrocyanic acid); the latter entering through a separate tube of small bore sealed below in mercury.

(4) *Ammonia (or Hydrocyanic Acid) Cylinder.*—A cylinder of capacity about 1100 c.c., provided with stopcock and small-bore delivery-tube above, and connected below with a mercury reservoir. The cylinder was filled with gas by placing it alternatively in connection with a vacuum

TABLE IIIA.—*Hydrocyanic Acid; its Stability in Presence of Wood Charcoal. Diluent Moist Coal Gas.*

Volume of Packing, 230 c.c.; 68 grammes. Temperature, 935° C.

0° C., 760 mm.	Hydrocyanic Acid and Coal Gas. Moist Gases per Minute, 0° C., 760 mm.		Coal Gas only. Moist Gas per Minute, 0° C., 760° mm.			
	78 c.c.		71 c.c.		145 c.c.	
	Entering.	Leaving.	Entering.	Leaving.	Entering.	Leaving.
Experiment No.	11		12		13	
Coal gas used (excluding HCy) dry . c.c.	4307	5160	4200	4810	4270	4550
Per 100 volumes—						
CO_2	0·1	0·1	0·2	0·2	0·1	0·1
O	0·6	..	0·7	0·1	0·8	0·3
CO	17·2	17·8	18·0	18·5	15·8	17·1
CH_4	27·2	12·2	27·4	16·9	27·7	21·4
H	48·7	62·8	50·2	57 8	51·0	54·7
N	6·2	7·1	3 5	6·5	4·6	6·4
	100·0	100·0	100·0	100·0	100·0	100·0
Aqueous vapour . c.c.	76	..	76	..	66	..
Hydrocyanic acid (dry) . c.c.	53	58	*Nil*	21	*Nil*	8
Duration of experiment . minutes	57	..	60	..	30	..
Increase of volume . . . per cent. of dry gas entering (excluding HCy)	..	19·8	..	12 6	..	6·5

TABLE IIIB.—*Yield of Hydrocyanic Acid and Ammonia, and Distribution of Products, Methane 935° C.*

—	Hydrocyanic Acid and Coal Gas.	Coal Gas only.	
	Slow Rate.	Slow Rate.	Rapid Rate.
Experiment No.	11	12	13
Aqueous vapour. . . . gramme	0·061	0·061	0·053
Methane balance—			
CH_4 entering, calculated as carbon	0·630	0·618	0·637
Products, per cent.—			
CH_4 undecomposed	53·8	70·7	82·5
Oxidized to CO	15·2	11·5	8·6
As hydrocyanic acid	0 5	1·8	0·6
As solid carbon* (by difference)	30·5	16·0	8·3
[* This figure includes carbonic acid removed by final soda catch.]	100·0	100·0	100·0
Ammonia obtained . . . gramme	0·056	0·032	0·008
Hydrocyanic acid obtained (excess leaving over that entering) calculated as NH_3 . . . gramme	0·004	0·016	0·006

exhaust and a generating flask delivering pure dry ammonia gas. The cylinder was provided with a scale calibrated throughout. The volume of ammonia used for an experiment was about 500 c.c.; the remainder (about 600 c.c.) was absorbed in water, and titrated on N/2 H_2SO_4. This figure, together with volume, pressure, and temperature data, enabled the ammonia content of the gas actually used in an experiment to be determined with sufficient accuracy. The cylinder was also employed in one experiment (No. 11, Tables IIIA. and IIIB) as a reservoir for dilute hydrocyanic acid. The diluent used was coal gas from the bolt-head reservoir. The hydrocyanic content of the gas used was determined by shaking the residual gas (600 c.c.) with caustic soda solution, as in the case of ammonia, and titrating with N/10 $AgNO_3$.

(5) *Furnace Tube and Packing.*—Tubes of fused silica were employed throughout 1 inch diameter inside measurement, and total length 3 feet. The volume of packing was adjusted so as to maintain practically the whole of it at the temperature of the furnace. Pyrometer readings were taken with two platinum platinum-iridium couples encased in small-bore silica tubes within and without; the reaction-tube itself showing extremely small variation (5° C. to 10° C.). The effective length of the packing was 24 inches in the Erlenmeyer furnace, 18 inches in the Méker burner; the ends of the tube projecting beyond the furnace in each case being kept empty, and at a temperature exceeding 100° C. to prevent condensation.

As regards packing, the porcelain employed was a pure white biscuit ware, broken down to the size of a small bean, and sieved to remove powder. On use, the colour turned grey, approaching to black after repeated use; but the colour was ingrained, and in no case did any flocculent carbon separate.

A sample of the dark grey material was found to contain, on analysis: Carbon, 0·32 per cent.; iron, 0·14 per cent. The discoloration was proved to be due to the presence of both carbon and iron, as the amount of the latter, after removal of the carbon, was sufficient to impart a distinct grey tinge to the porcelain. After extraction of both carbon and iron, the resulting material was pure white, indistinguishable in appearance from the original porcelain before use. The latter showed no loss of weight on ignition in air, and yielded traces only of iron on extraction with acid (0·004 per cent. Fe). The presence of iron in the grey material is attributed to the decomposition of iron carbonyl in the coal gas used.

The wood charcoal was that employed for blowpipe work, graded and sieved as in the case of the porcelain. (Ash, after repeated use, 1·7 per cent.) When first of all heated in a current of coal gas, a considerable amount of water was evolved and some pyroligneous matter. The material absorbed moisture readily, and retained it with extreme obstinacy, the evidence of its presence being afforded by the steady evolution of gases resembling water gas in composition when the charcoal was heated in coal gas. The difficulty was finally overcome by placing the furnace tube in each experiment under exhaust for several minutes at 800° C., destroying the vacuum with coal gas, and repeating the process two or three times.

The weight of contact material raised to constant reacting temperature and the volume of the tube occupied by it are given in the headings to the tables; these figures being approximate only.

(6) *Absorbing and Sampling Vessels.*—The exit gases were passed successively through one or more Drechsel's bottles containing standard H_2SO_4 to absorb ammonia, and through caustic soda to absorb hydrocyanic acid, before entering the water aspirator in which they were stored and measured. A stoppered cylinder filled with mercury or water was interposed between the acid and soda catches to sample the gases over the whole or any desired portion of the "run." A layer of oil was placed on the surface of the water in the aspirator to minimize absorption of carbon dioxide when water was used in place of soda in the exit catch before the aspirator. The amount of this constituent proved, however, to be much smaller than was expected, and the carbon equivalent of the carbon dioxide has little significance in the methane balance-sheets presented below.

(7) *Determination of Temperature.*—A platinum platinum-iridium couple was employed throughout the work, connected with a direct-reading Paul "single pivot galvanometer" with a range from 100° C. to 1400° C. In the earlier experiments, the thermo-junction was placed within the furnace tube enclosed in a silica tube of small bore. On two occasions, however, the junction was seriously attacked by the reacting gases, which entered through a fracture in the silica sheath, and it was found advisable in the later experiments to place the couple immediately above the furnace tube and in the furnace itself. As previously stated, thermo-junctions within and without the furnace tube gave practically identical readings on the galvanometer, proving that temperature conditions were extremely constant throughout the working region.

ANALYSIS OF GASES.

The analyses were carried out with a Stead's apparatus with mercury. Care was taken to apply necessary corrections for the volume of gas in the capillary connections. Oxygen was determined by absorption in pyrogallate, carbonic oxide by absorption in cuprous chloride, and combustible gases were exploded with excess of oxygen, followed by absorption of CO_2 in soda. The CO_2 so obtained was calculated as CH_4, and the H_2 reached by calculation, the nitrogen by difference. The presence of ethane, &c., was thus excluded from consideration. This is allowable in presenting a carbon balance-sheet; but the figures for CH_4 and H_2 presented in the tables afford no exact data for determining the relationship $\frac{CH_4}{H_2}$.

An important point arises: How far was the procedure effective in excluding adventitious air? It is impossible to speak with absolute certainty on this point in the absence of direct estimation of nitrogen. The nitrogen figures are difference figures, and have therefore to bear the brunt of the whole analysis. It is,

TABLE IV.—*Action of Wood Charcoal on Coal Gas. Yields of Ammonia and Hydrocyanic Acid per* 1000 *c.c. Coal Gas Used.*

Conditions.	720° C.	735° C.	745° C.	835° C.	935° C.	
					Slow Rate.	Rapid Rate.
Experiment No.	10	5	9	6	12	13
Nitrogen . . . per cent. by volume in coal gas	5·1	3·9	5·7	6·0	3·5	4·6
Rate of flow (moist gas) . . c.c. per minute .	55·0	39·0	44·0	38·0	71·0	145·0
Aqueous vapour . . . . . gramme .	0·360	*Nil*	0·110	*Nil*	0·015	0·012
Products—						
Ammonia . . . . . gramme .	0·002	0·001	0·003	0·002	0·008	0·002
Hydrocyanic acid (as NH_3) . . ,, .	*Nil*	*Nil*	*Nil*	*Nil*	0·004	0·001
Total	0·002	0·001	0·003	0·002	0·012	0·003

nevertheless, believed that the apparatus employed was very free from blemish in respect of air leakage. The tube showed no signs of leakage on exhaustion; the rate of flow was exceedingly sensitive to changes of pressure at the inlet and exit ends of the apparatus; experiments Nos. 7 and 8 show extremely close agreement between the volumes and composition of inlet and outlet gases, when allowance is made for the oxidizing effect of contained oxygen; and, lastly, the carbon dioxide and nitrogen figures afford general support; though, as already stated, the latter are regarded with reserve.

Ammonia and Methane Balance-Sheets.

Methods of Calculation.—The ammonia entering the furnace tube (see under "Apparatus," item No. 4) is equated against the sum of the ammonia and hydrocyanic acid (calculated as NH_3) leaving the tube. The difference is taken to be "ammonia decomposed" into its elements thermally. No account is taken in such calculation of the ammonia produced by direct interaction of nitrogen and hydrogen in presence of carbon. The figures for "ammonia decomposed" presented in Tables V. and VI. are, therefore, in every case minimum figures. Results in Table IV. indicate that with the large volumes of gas employed—as much as 4000 c.c. in some experiments—the amount of ammonia thus contributed to the yield by direct interaction of nitrogen and hydrogen is by no means negligible, and that the figure "ammonia decomposed" would at high temperatures be substantially greater were it possible to exclude the ammonia and hydrocyanic acid derived from the nitrogen of the coal gas used, or possibly from traces of nitrogen present in wood charcoal itself when that material was employed as contact material. The wood charcoal, however, was very free from ash—only 1·7 per cent. (Table IIIB., No. 12); ammonia formed, 0·032 gramme; hydrocyanic acid (as NH_3), 0·016 gramme.

In the case of the methane balance we are equally unable to correct the figures presented for carbon contributed to the gases by interaction of the wood charcoal with ammonia, oxygen, or aqueous vapour. The figures "solid carbon (by difference)," in the case of this contact material, must also, therefore, be regarded as minimum figures.

It was felt to be beyond the scope of the present research to attempt to determine the relative parts played by gaseous and solid carbon in such reactions as we have been discussing. The results presented in the accompanying tables, however, afford abundant evidence that methane yields nascent carbon by thermal decomposition at temperatures far below those at which carbon will react, under the conditions of the experiments, either with ammonia or nitrogen to form hydrocyanic acid; but the results summarized do not permit us to say any more than this.

Analytical Results.

Tables IA. and IB.

Experiments Nos. 1 to 6.—Action of Porcelain and Wood Charcoal on Dry Coal Gas.

In these experiments, the volumes of gas used and the rates of flow were kept as constant as possible. For this end, the coal gas used in the experimental "run" at constant temperature was stored in a Winchester quart bottle holding approximately 2500 c.c., provided with rubber stopper and the necessary connections. The whole of this gas was sent through the furnace tube as soon as constant temperature conditions had been attained. Coal gas was used to drive out air, and while the furnace was heating up, was allowed to escape at the final water aspirator. The exit gases were passed through two Drechsel's bottles placed in sequence; the first containing 50 c.c. of N/10 H_2SO_4, the second 25 c.c. of distilled water, thence to a water aspirator. A bye-pass placed between the two bottles enabled the gases to be continuously sampled over the whole "run" by a stoppered mercury cylinder. Hydrocyanic acid dissolves so completely in water when present in small amount, that the use of caustic soda was dispensed with here.

Table IA. shows for each experiment the volume of coal gas used (0° C., 760 mm.); its composition per 100 volumes before and after passing through the tube; the duration of the experiment;* the rate of flow of the inlet gas; the increase in volume of the latter per 100 volumes (dry, at 0° C., 760 mm.); and the number of minutes taken by the gas in passing through the heated tube.

Table IB. shows for each experiment the weight of marsh gas entering the tube (calculated as grammes of carbon); and the distribution of the products per 100 parts of the same by weight, calculated on the assumption that the decrease in weight of methane due to passing through the tube is due to its conversion into other forms—by oxidation to carbonic oxide and carbonic acid, by interaction with nitrogen to hydrocyanic acid, and by thermal decomposition to "solid carbon (by difference)." As already stated, no account is taken in the methane balance of any carbon contributed to the gaseous mixture by interaction of the constituent gases with wood charcoal itself.

Tables IIA. and IIB.

Experiments Nos. 7 to 10.—Action of Porcelain and Wood Charcoal on Moist Coal Gas.

In these experiments, the apparatus used and the procedure followed were those described in the experiments on dry coal gas, with the necessary replacement at the inlet end of a drying by a water-saturation system.

In Table IIA., the total volume of gas entering the tube—from which the "rate of flow" is calculated—is the combined volumes of coal gas and aqueous vapour, both measured at 0° C., 760 mm. On the other hand, no account is taken in the figure "increase in volume" of any aqueous vapour entering or leaving the tube. This figure, as before, denotes the increase in volume of the inlet coal gas per 100 volumes (dry, 0° C., 760 mm.).

Table IIB. shows for each experiment the weight of aqueous vapour entering the tube with the inlet gas, the distribution of the products derived from the methane, and the weight of ammonia produced.

Tables IIIA. and IIIB.

Hydrocyanic Acid; its Stability in Presence of Wood Charcoal with Moist Coal Gas as Diluent.

A measured volume of coal gas saturated with aqueous vapour at atmospheric temperature was passed through a tube packed with wood charcoal at a temperature of 935° C. The exit gases were passed successively through two Drechsel's bottles, the first containing 50 c.c. of N/10 H_2SO_4, the second 25 c.c. of N. potash, thence to a water aspirator, where they were measured and sampled. No account was taken of the carbonic acid produced in these experiments. The figures for "solid carbon" are slightly high in consequence; they include carbon oxidized to carbonic acid. In experiment No. 11, 53 c.c. of hydrocyanic acid were admitted with the inlet gas; in experiments Nos. 12 and 13, none.

In Table IIIB., a methane balance is presented for each experiment, calculated in the usual way. The figure "CH_4 as cyanide, 0·5 per cent." (No. 11), denotes the increase in hydrocyanic acid due to passing through the tube, calculated per 100 parts of carbon as methane entering; the calculation, as before, being based on the assumption that gaseous carbon (methane) alone takes part in reactions within the tube.

Table IV.

Action of Wood Charcoal on Coal Gas, Dry and Moist.—Yields of Ammonia and Hydrocyanic Acid.

In Table IV., the yields of hydrocyanic acid and of ammonia per 1000 c.c. of coal gas entering (0° C., 760 mm.) at various temperatures and rates of flow are brought together for convenience of reference. The results are approximate only, as no account is taken of the ammonia and hydrocyanic acid produced while the furnace tube was being heated up in a slow current of coal gas; the exit gases escaping through the acid and the soda catch-vessels during the whole of this period.

Tables VA. and VB., VIA. and VIB.

Influence of Temperature on Interaction of Methane and Ammonia.

In these experiments, measured volumes of coal gas, saturated with aqueous vapour at atmospheric temperature, and of dry ammonia gas (95 to 98 per cent. NH_3) were conducted in two regulated streams to a water-jacketed mixing-flask, and thence to a furnace tube packed with porcelain or wood charcoal. The supply of ammonia was turned on within two minutes of attaining constant temperature conditions and starting the inlet coal gas and exit water aspirator. It was shut off five to ten minutes before the coal gas, to enable the ammonia in the mixing-flask to be displaced and carried forward through the furnace tube to the catch-vessels beyond before the end of the experiment.

* The expression "duration of experiment" denotes here and elsewhere in this research the number of minutes occupied in the experimental "run," measured from the moment when constant temperature conditions were attained to the moment when the supply of inlet gas was shut off and the water aspirator stopped; and the expression "coal gas used" denotes the volume of inlet gas used within such period.

TABLE VA.—*Influence of Temperature on the Interaction of Methane and Ammonia (Slow Rate of Flow).*

[Col. (*a*), gas entering tube; col. (*b*), gas leaving tube.]

0° C. 760 mm.	Porcelain (Light Grey).						Wood Charcoal.							
	310 c.c., 270 Grammes.				230 c.c., 200 Grammes.		270 c.c., 80 Grammes.				230 c.c., 68 Grammes.			
	780° C.		800° C.		915° C.		755° C.		770° C.		805° C.		930° C.	
Experiment No.	14 (*a*)	(*b*)	15 (*a*)	(*b*)	16 (*a*)	(*b*)	17 (*a*)	(*b*)	18 (*a*)	(*b*)	19 (*a*)	(*b*)	20 (*a*)	(*b*)
Gas used (excluding NH_3), dry c.c.	4970	5120	4865	5545	3855	5985	4630	5760	4540	5620	3780	4335	3710	5940
Per 100 volumes—														
CO_2	..	0·1	0·1	0·2	0·2	0·1	0·3	0·8	0·1	0·4	0·1	0·4	0·2	0·2
O	0·8	0·2	0·8	..	0·4	0·1	0·6	0·2	0·8	0·1	0·5	0·1	0·6	0·1
CO	12·1	12·3	2·4	2·6	20·1	17·6	15·0	13·2	10·9	11·3	13·3	12·9	19·9	14·6
CH_4	31·5	27·8	86·3	74·3	26·1	5·6	29·1	16·4	40·9	18·8	31·3	22·1	25·7	4·1
H	49·6	50·6	8·9	18·4	50·0	68·6	48·9	63·1	41·2	64·3	48·4	57·0	51·3	74·7
N	6·0	9·0	1·5	4·6	3·2	8·0	6·1	6·8	6·1	5·1	6·4	7·5	2·3	6·3
	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Aqueous vapour c.c.	127	..	118	..	70	..	135	..	132	..	56	..	65	..
Ammonia (pure dry) ,,	444	..	448	..	510	..	474	..	*Nil*	..	477	..	467	..
Duration of experiment minutes	64	..	58	..	68	..	64	..	65	..	46	..	65	..
Rate of flow (moist gas + NH_3) c.c. per minute	87	..	94	..	65	..	82	..	72	..	94	..	66	..
Increase in volume, per cent. of dry gas entering (excluding NH_3)	..	3·0	..	11·9	..	55·2	..	24·4	..	23·8	..	14·7	..	60·1

TABLE VB.—*Distribution of Products, Ammonia, and Methane (Slow Rate of Flow).*

—	Porcelain (Light Grey).			Wood Charcoal.			
	780° C.	800° C.	915° C.	755° C.	770° C.	805° C.	930° C.
Experiment No.	14	15	16	17	18	19	20
Aqueous vapour. gramme	0·102	0·095	0·056	0·108	0·106	0 056	0·052
Ammonia balance—							
NH_3 entering gramme	0·338	0·341	0·389	0·361	*Nil*	0·363	0·356
,, products, per cent.—							
NH_3 undecomposed	55·0	58·4	1·0	41·0	..	67·8	5·9
,, as hydrocyanic acid	3·3	2·6	*Nil*	*Nil*	..	10·7	0·3
,, dissociated (by difference)	41·7	39·0	99 0	59·0	..	21·5	93·8
	100·0	100·0	100·0	100·0	..	100·0	100·0
Methane balance—							
CH_4 entering as carbon gramme	0·842	2·326	0·541	0·725	0·999	0·636	0·512
,, Products, per cent.—							
CH_4 undecomposed	91·0	96·2	33·5	70·1	56·9	81·0	25·6
Oxidized to CO + CO_2	2·0	0·7	27·3	7·4	8·6	6·0	14·0
As hydrocyanic acid	1·0	0·3	*Nil*	*Nil*	*Nil*	4·2	Trace
As solid carbon (by difference)	6·0	2·8	39·2	22·5	34·5	8·8	60·4
	100·0	100·0	100·0	100·0	100·0	100·0	100·0

The exit gases passed successively through two Drechsel's bottles charged respectively with 40 c.c. of N/2 H_2SO_4 and 25 c.c. of N/5 H_2SO_4, and a Woulfe bottle containing 25 c.c. of N/2 NaOH, and thence to a water aspirator, where they were measured and sampled. A stoppered water cylinder was placed between the second acid and soda catches, to enable the gases to be sampled over 15 minutes during the central period of each "run." Coal gas used to expel air from the apparatus and while constant temperature conditions were being attained was allowed to escape at the final water aspirator.

In Tables VA. and VIA., as already explained, the figures denoting volumes of gas entering and leaving the tube, and increase in volume, relate to gases measured after a constant temperature had been attained. The rates of flow are based on the total volume of combined gas entering; coal gas, aqueous vapour, and ammonia (including the small amount of air associated therewith) are all measured at 0° C., 760 mm. In Tables VA. and VB. are grouped the results conducted at "slow rates of flow"—65 c.c. to 94 c.c. per minute; and in Tables VIA. and VIB., similar results obtained at "rapid rates of flow"—188 c.c. to 202 c.c. per minute.

CONCLUSIONS.

Tables IA. and IB.

Action of Porcelain and Wood Charcoal on Dry Coal Gas.

Wood charcoal has a marked thermal effect on dry coal gas below 750° C. This effect rapidly increases with rise of temperature. Thus, at 735° C. (No. 5), solid carbon 39·6 per cent.; at 835° C. (No. 6), solid carbon 60·9 per cent. Traces of ammonia are produced, but no hydrocyanic acid below 835° C.

Porcelain at 770° C. has no effect on dry coal gas, either oxidizing or thermal (No. 4). Above 850° C., both effects are strongly marked. With white unused porcelain, the oxidizing effect predominates; with dark grey porcelain, after repeated use, the thermal. Thus—

White porcelain.—900° C. (No. 1), CH_4 oxidized, 366 per cent.; solid carbon, 14 per cent.

Dark grey porcelain.—870° C. (No. 3), CH_4 oxidized, 19·1 per cent.; solid carbon, 46·2 per cent.

But the thermal effect is markedly less than with wood charcoal. Thus—

Wood charcoal.—835° C. (No. 6), solid carbon, 60·9 per cent.

Ammonia was not estimated in experiments Nos. 1 to 4 with porcelain. No hydrocyanic acid was produced at 770° C., 860° C., 870° C. It was not looked for at 900° C., the oxidation effect on methane being so marked. The results generally indicate that methane suffers thermal decomposition at temperatures below that at which carbon is capable of reacting with nitrogen to form hydrocyanic acid.

Tables IIA. and IIB.

Action of Porcelain and Wood Charcoal on Moist Coal Gas.

Porcelain below 765° C. has no appreciable effect on moist coal gas, either oxidizing or thermal (Nos. 7 and 8).

In addition to the marked thermal effect that characterizes the action of wood charcoal on dry coal gas an oxidizing effect is noticeable with the moist gas, the product of such action being mainly carbonic oxide. But the action of moisture is partial only at the comparatively low temperature attained (745° C.), and the aqueous vapour at the same time acts as a protective both to the methane and ammonia; the figures for "solid carbon" showing marked reduction, and those for ammonia marked increase, over the corresponding figures for dry coal gas. Thus—

Dry, at 735° C. (No. 5)—methane decomposed—	Per Cent.	Moist, at 745° C. (No. 9)—methane decomposed—	Per Cent
Oxidized	3·0	Oxidized	20·2
To solid carbon	39·6	To solid carbon	27 5
Total	42·6	Total	47·7

Had the aqueous vapour admitted (0·255 gramme) completely interacted with solid or gaseous carbon, the figure 20·2 per cent. would have been greatly exceeded. Thus: (No. 9) Carbon as CH_4 oxidized to CO_2, 3·5 per cent. (equivalent to 7 per cent. carbon as CO); CO, 16·7 per cent.—total (as CO) 23·7 per cent.

0·255 gramme of H_2O is equivalent to $\frac{12}{18} \times 0{\cdot}255$ gramme carbon (as CO). Total methane entering, as carbon, 0·371 gramme. Hence, 0·255 gramme H_2O should oxidize—

$$\frac{12}{18} \times 0{\cdot}255 \times \frac{100}{0{\cdot}371} \text{ p. ct. methane entering} = 45{\cdot}8 \text{ p. ct.}$$

TABLE VIA.—*Influence of Temperature on the Interaction of Methane and Ammonia (Rapid Rate of Flow).*

[Col. (*a*), gas entering tube; col. (*b*), gas leaving tube.]

0° C., 760 mm.	Wood Charcoal. Volume, 230 c.c.; Weight, 68 Grammes.					
	805° C.		855° C.		905° C.	
Experiment No.	21		22		23	
	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)
Gas used (excluding NH_3) dry c.c.	4495	4780	4485	5485	4130	5840
Per 100 volumes—						
CO_2	0·1	0·3	0·1	0·3	..	0·2
O	1·2	0·2	1·1	0·2	0·6	0·2
CO	20 9	21·2	18·3	17·6	17·9	15·0
CH_4	23·7	19·3	26·7	15·4	27·8	8·8
H	46·4	51·3	49·4	60·2	49·5	69·3
N	7·7	7·7	4·4	6·3	4·2	6·5
	100·0	100·0	100·0	100·0	100·0	100·0
Aqueous vapour c.c.	76	..	72	..	78	..
Ammonia (pure, dry) ,,	356	..	482	..	481	..
Duration of experiment min.	25	..	25	..	25	..
Rate of flow c.c. per min.	197	..	202	..	188	..
Increase in volume per cent. of dry gas entering (excluding NH_3)	..	6·3	..	22·3	..	41·5

TABLE VIB.—*Distribution of Products, Ammonia, and Methane (Rapid Rate of Flow).*

—	Wood Charcoal.		
	805° C.	855° C.	905° C
Experiment No.	21	22	23
Aqueous vapour gramme	0·061	0·058	0·062
Ammonia balance—			
NH_3 entering gramme	0·272	0·367	0·366
,, products, per cent.—			
NH_3 undecomposed	84·6	44·4	23·5
,, as hydrocyanic acid	9·2	19·7	10·1
,, dissociated (by diff.)	6·2	35·9	66·4
	100·0	100·0	100·0
Methane balance—			
CH_4 entering, calculated as C. gramme	0·572	0·644	0·617
Products, per cent.—			
CH_4 undecomposed	86·7	70·5	44·7
Oxidized to $CO + CO_2$	8·1	13·0	12·8
As hydrocyanic acid	3·1	7·9	4·2
As solid carbon (by difference)	2·1	8·6	38·3
	100·0	100·0	100·0

The oxidizing effect of aqueous vapour on methane, as well as on illuminants, has an important bearing on the economy of carbonization when steam is admitted, as in the Dessau intermittent vertical retort, towards the close of the carbonization process; one of the objects of forming water gas thereby being to assist in the rapid removal of the products of distillation.* But the question is beyond the scope of the present research.

Tables IIIA. and IIIB.

Hydrocyanic Acid; its Stability in Presence of Wood Charcoal.

Results show that hydrocyanic acid is stable at 935° C. in presence of wood charcoal and with moist coal gas as diluent; and, further, that traces of hydrocyanic acid are formed under the observed conditions—a conclusion confirmed by the results of experiments Nos. 12 and 13. Thus, in No. 11, 53 c.c. of hydrocyanic acid gas were sent into the tube, and 58 c.c. were obtained at the exit. It is interesting to observe that ammonia is also produced in amount exceeding that of the hydrocyanic acid. We know that ammonia itself reacts with carbon to form hydrocyanic acid under the observed conditions (see Tables V., VI.). It is probable, therefore, that the hydrocyanic acid obtained in experiments Nos. 11, 12, and 13, was a secondary product produced by interaction of the primary product, ammonia, with carbon, derived either from thermal decomposition of the methane or from the wood charcoal employed as contact material. This view receives confirmation from the fact that conditions which favour the formation of hydrocyanic acid when coal gas alone is passed over wood charcoal—viz., slow rate of flow and high temperature—are also favourable to the formation of ammonia (see Table IV.).

Table IV.

Action of Wood Charcoal on Coal Gas.—Yields of Ammonia and Hydrocyanic Acid.

Ammonia is produced at all temperatures between 720° C. and 935° C. Its formation is favoured by high temperature and reduced rate of flow. Thus—

At 835° C. (No. 6), rate of flow, 38 c.c. per minute; yield per 1000 c.c., 0·002 gramme NH_3.

At 935° C. (No. 12), rate of flow, 71 c.c. per minute; yield per 1000 c.c., 0·008 gramme NH_3.

At 935° C. (No. 13), rate of flow, 145 c.c. per minute; yield per 1000 c.c., 0·002 gramme NH_3.

Hydrocyanic acid, on the other hand, is not produced in appreciable amount under the conditions of the experiment by direct interaction of nitrogen and carbon below 835° C. Its formation is favoured by high temperature and reduced rate of flow.

Tables VA. and VB.; VIA. and VIB.

Influence of Temperature on Interaction of Methane and Ammonia.

Porcelain.—Below 800° C., oxidization and thermal effects on methane are insignificant. Hydrocyanic acid is produced, but in small amount. Ammonia survives in large proportion. Above 900° C., oxidization and thermal effects are marked. Hydrocyanic acid, if produced at slow rate of flow, is entirely destroyed. Ammonia, likewise, is practically completely dissociated into its elements. Thus—

At 800° C. (Table VB., Experiment No. 15)—
Methane decomposed—

	Per Cent.
By oxidization	0·7
To solid carbon	2·8
Total	3·5
Ammonia converted into hydrocyanic acid	2·6
Ammonia dissociated into its elements	39·0

* *Vide* Dr. Colman, "JOURNAL," Vol. CI., p. 683.

At 915° C. (Table VB., Experiment No. 16)—
Methane decomposed—

	Per Cent.
By oxidization	27·3
To solid carbon	39·2
Total	66·5
Ammonia converted into hydrocyanic acid	*Nil.*
Ammonia dissociated into its elements	99·0

Wood Charcoal.—At 755° C. (slow rate of flow), the thermal effect on methane is marked; but no hydrocyanic acid is produced, although conditions are favourable to its formation, both in respect to survival of ammonia and amount of solid carbon formed. (See experiment No. 17, Table VB.) At 805° C., hydrocyanic acid makes its appearance; but the yield is but slightly affected by reducing the rate of flow. Thus—

Slow rate of flow, 94 c.c. per minute (Table VB., No. 19), NH_3 per cent. as HCy, 10·7.

Rapid rate of flow, 197 c.c. per minute (Table VIB., No. 21), NH_3 per cent. as HCy, 9·2.

Above 900° C., on the other hand, rate of flow has a profound effect upon the yield. Thus—

Rate of flow 66 c.c. per minute, at 930° C. (Table VB., No. 20), NH_3 per cent. as HCy, 0·3.

Rate of flow 188 c.c. per minute, at 905° C. (Table VIB., No. 23), NH_3 per cent. as HCy, 10·1.

The critical temperature for the formation of hydrocyanic acid is, therefore, considered to lie between 755° C. and 805° C. The reduced yield at the slower rate is attributed to the more rapid dissociation of ammonia into its elements, as the results presented in Table IIIB. show that hydrocyanic once produced is stable at a temperature of 935° C. Thus—

Slow rate of flow, at 930° C. (No. 20), NH_3 as HCy, 0·3 per cent.; NH_3 dissociated, 93·8 per cent.

Rapid rate of flow, at 905° C. (No. 23), NH_3 as HCy, 10·1 per cent.; NH_3 dissociated, 66·4 per cent.

The balance of ammonia surviving in experiment No. 20 (5·9 per cent.) is probably derived in large measure from the direct interaction of nitrogen and carbon. (See remarks on Tables III. and IV.)

The maximum yield of hydrocyanic acid under the conditions of the experiments was obtained at 855° C., rapid rate of flow 202 c.c. per minute, 19·7 per cent. of the ammonia used. (See Table VIB., No. 22.) In this experiment, 44·4 per cent. of the ammonia survived the passage through the tube. Had opportunity occurred for repeating the experiment at the same temperature, but at a reduced rate of flow, the yield of hydrocyanic acid would probably have reached an even higher figure.

PROBLEMS OF CARBONIZATION IN CONTINUOUS VERTICAL RETORTS.

It is hoped that the study of the preceding observations may prove of some practical aid in the elucidation of problems presented in the conduct of large-scale operations of carbonizing coal in continuous vertical retorts, where, in so many respects, marked differences appear in the liquid and gaseous products obtained as compared with carbonizing the same coal in horizontal retorts.

So far as the interests of the department are effected, the chief difference that appeared in the gas liquor analyses of 1907-8 lay in the increased ratio of hydrocyanic acid to ammonia in the liquors from the continuous vertical retort. The tars have not yet been so critically examined here. It is, however, already known that their distillation is not characterized by any increase

of difficulty from their special physical properties; indeed, the reverse is the case, in so far as the percentage of naphthalene is lessened—the tar presenting generally the character hitherto associated with low-temperature carbonization. The experimental work above described necessarily branched off as it proceeded to consideration of problems occurring in retort-house practice—viz., to the genesis of hydrocyanic acid and ammonia.

It has, unfortunately, not been possible to ascertain temperatures of the interior of the continuous vertical retort (Woodall-Duckham) at different levels. The difficulties attendant upon introducing the leads of an electrical pyrometer are considerable, since the mass of material in the retort is always moving downwards. The zone of maximum temperature attained varies in level by the operation of various factors—nature of coal, rate of feed, &c. As to some of the reactions that might be expected to take place in this zone, and to the possibilities of which these experiments point, I have made some remarks in the introduction to this record of work; but they can only be made tentatively and with reserve.

What is known is that the heat conveyed as sensible heat through the walls of the retort (the temperature in the flues is highest near the top, as this is where the gas and air are introduced and combustion takes place) rapidly becomes latent; being engaged on the work of distillation, so that only at a point about three-fifths of the length, reckoning downwards from the top, does the bulk of the material in process of carbonization attain its maximum temperature. Locally, near the wall of the retort, some material and some of the ascending gases suffer from exposure to excess of temperature, as is evidenced by the occurrence of gas carbon at various points. Professor Bone endorses as probable that such graphitic carbon results from decomposition of methane.

As regards the rate of flow of gases through the retort, and the time of contact of such gases, both with the walls of the retort and with the charge, no very direct comparison is possible between the results of laboratory and large-scale working, conditions being so different. But it may be of interest to state that the estimated time taken by the coal gas in passing through the tube used in the experiments recorded in Tables I. and II. is very similar to that calculated by Mr. Thomas Holgate from the carbonization figures for horizontal retorts supplied by Mr. John Bond in his paper read before the Institution of Gas Engineers in 1905; due allowance being made in both cases for the volume occupied by the packing. In Tables I. and II., times of contact are calculated for gases entering at 0° C., 760 mm. dry. Mr. Bond's figures, I am informed, relate to purified coal gas measured at 60° Fahr., 30 in. mercury.* Thus (Table Ia., No. 1)—

Volume of tube, 230 c.c., less packing (200 grammes) 130 c.c. = 100 c.c.

Volume of gas entering per minute, 0° C., 760 mm. = 38 c.c.

Hence the time of gas in the tube is 100 ÷ 38 = 2·6 minutes.

Mr. Holgate's estimate of the time of gas in the retort varies from 2·7 minutes at the start to 5·6 minutes at the end of the distillation. In experiments Nos. 11 to 13 (Table IIIa.), the time varied from 1·3 to 2·6 minutes; in Nos. 14 to 20 (Table Va.), from 0·8 to 2·1 minutes; and in Nos. 21 to 23 (Table VIa.), it approximated to 0·4 minute.

It has been increasingly evident, during the progress of this work, that to reach satisfactory and adequate conclusions, its scope needs extending. To continue the work, therefore, in this laboratory is felt to be impossible, since to carry out such experimental work satisfactorily great and continuous devotion of thought and energy is required. The conditions imposed by the claims of administrative official duties prevent this. We believe the results here presented to be as accurate as were possible of attainment under the disadvantages existing. Only in a technological institution like that at Carlsruhe, for so long under Dr. Bunte's able direction, or in the more recently established technical laboratory at the University of Leeds, under the guidance of Professor Bone, F.R.S., whose researches into the decomposition of gaseous hydrocarbons at high temperatures have placed him in such an exceptionally advantageous position for contributing data of value towards the scientific advancement of the gas industry, can such experimental work as this be properly undertaken.

In conclusion, I desire to recognize most warmly the zealous devotion of Mr. Linder throughout the research, for without his most able collaboration nothing would have been accomplished. If the work possesses value, the credit is really due to him.

* See "JOURNAL," Vol. CVI., p. 25.

Some interesting experiments are being conducted by the South Park Commissioners of Chicago in the lighting of the boulevards under their control. Several different types of lamps have been installed on temporary posts, in order that the comparative illuminating effect may be observed, and a determination made of how high the lamps should be hung, how far apart, and similar considerations. The lamps now under test (or about to be tested) include incandescent gas-lamps, enclosed arcs, magnetite arcs, flaming arcs, and incandescent tungsten lamps. The Commissioners hope to obtain valuable data, both as regards illumination and economy, from these trials; the latter being an important factor, as it is estimated that a million kilowatt-hours per annum will be required for the lighting of Grant Park alone.

DELETERIOUS EFFECTS OF BRIGHT LIGHT UPON THE EYES.

In "Science Progress" for July, Dr. J. H. Parsons, F.R.C.S. (Eng.), of University College, discusses, under the above title, the physiological causes of cataract and other eye ailments, as induced by powerful and unsuitable lights. From considerations based upon professional experience, and from special experiments with lights of definite intensity, including one of 3000-candle power, he says: "Hence, there is ample evidence to show that ultra-violet rays are deleterious to the eyes, not only in so far as the superficial structures are concerned, but also the deep; further, that prolonged action of weak doses is also to be avoided." All the more recent forms of electric lamp emit light rich in ultra-violet rays. This is specially true of arc lamps, in which the carbons are impregnated with metals or have a metal core. It is true in less, but still marked, degree of the various metallic filament electric lamps—the osram, the tantalum, &c.—as well as Nernst lamps.

The most powerful ultra-violet lamp is a mercury vapour lamp, in which the tube is made of quartz, and in which the mercury vapour is under pressure. By increasing the pressure, the spectrum obtained, instead of consisting of isolated lines or groups of lines, becomes continuous. Great heat, however, is developed by these lamps, necessitating their being cooled by means of a water-jacket. Dr. Parsons does not, however, consider moderate heat so injurious as the ultra-violet character of the light. Upon this point, he says: "It is difficult to imagine that heat can penetrate far into the eye when we consider that water is a bad conductor, and that the space between the cornea and the crystalline lens is filled with watery fluid. In fact, the lens is admirably protected from heat by a water bath. Cases, too, occur in which molten metal at an extremely high temperature is splashed into the eye without causing the development of cataract. If, therefore, such intense degrees of heat as those under consideration fail to produce deleterious effects upon the deeper structures of the eye, it is probable that we may with safety eliminate this factor as of any importance when we come to deal with sources of illumination in which the output of heat is incomparably less." Though Dr. Parsons does not make any specific comparison of gas and electricity as suitable sources of light, yet from the above quotations it is quite evident gas must occupy a high position when considered from the standpoint of the ophthalmist. The use of the new glass called "Euphos," as an envelope round lamps that emit ultra-violet light is explained and recommended.

It may help in understanding the bearing of Dr. Parsons' remarks to have in mind the following particulars of the quartz mercury lamp. By the use of fused quartz instead of glass for the tubes of mercury lamps, much greater voltages, with accompanying increase of efficiency, may be obtained. Mercury lamps mounted in glass and intended to take 110 volts are more than 1 metre long, and 3 to 4 centimetres in diameter. If mounted in quartz, a similar lamp would be only 8 centimetres long and 1 or 1½ centimetres in diameter. To begin with, the column of light fills the whole of the quartz tube, but after a short time contracts to a narrow band, the light having now a slightly yellow tinge. Owing to the high temperature reached, the mercury vapour is at about atmospheric pressure. With an electrical pressure of 174 volts and a current of 4·2 ampères, the horizontal candle power in a direction at right angles to the axis of the tube was 3080 Hefners. These numbers (given by the Reichsanstalt) indicate an efficiency of 0·24 watt per candle.

In contrast with such an artificial light may be given the intensity of the light received by the earth from the moon. Messrs. J. Stebbins and F. C. Brown found it at "full moon" to be about 0·23 candle. Full moon is approximately nine times as bright as the half moon; and there is distinct evidence of the moon being brighter between the first quarter and full than in the corresponding phase after maximum. Though this was at first surprising, it is evident, after some consideration, that there are more dark areas on the eastern than on the western half of the moon's disc towards us, and in particular the third or south-west quadrant is brightest of all.

Engineering Day at the Imperial International Exhibition.—Arrangements have been made for holding an Engineering Congress at the Great White City next Saturday, under the presidency of the Lord Mayor (Sir G. Wyatt Truscott). A Joint Organizing Committee has been formed, with Mr. W. Worby Beaumont, M.Inst.C.E., as Chairman, and Mr. W. Yorath Lewis as Hon. Secretary, for carrying out the details. The idea is to bring together the members of the numerous societies relating to engineering; and it appears to have been heartily approved by several sections of the engineering community. The programme consists of three parts—an itinerary of the engineering features of the exhibition, special demonstrations in the machinery hall and in the building on the west side of the Court of Honour, and lectures in the Congress Hall. One of the lectures will be by Mr. Percy R. Allen, on "Large Gas-Engines;" and it will be illustrated by lantern slides and a fine collection of photographs, drawings, and models. Mr. Dugald Clerk will preside. At five o'clock there will be a reception by the Lord Mayor; and in the evening a banquet in the hall of the Garden Club.

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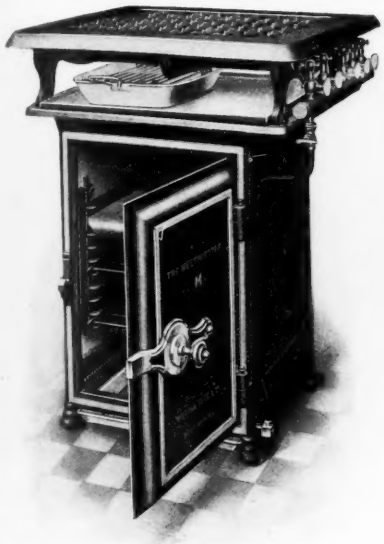

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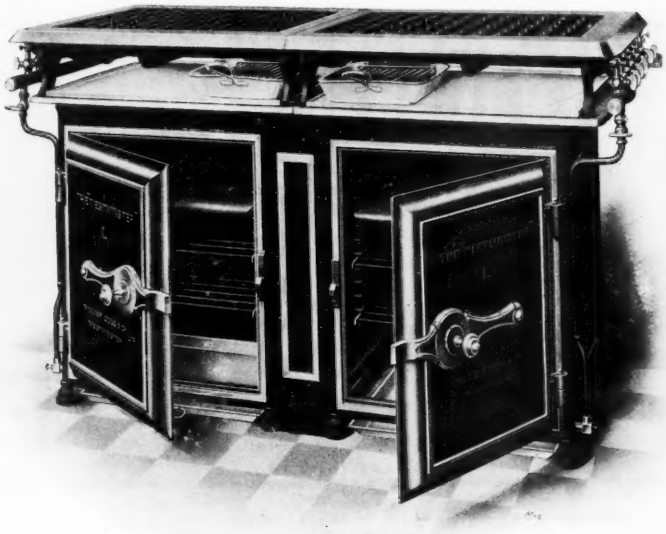

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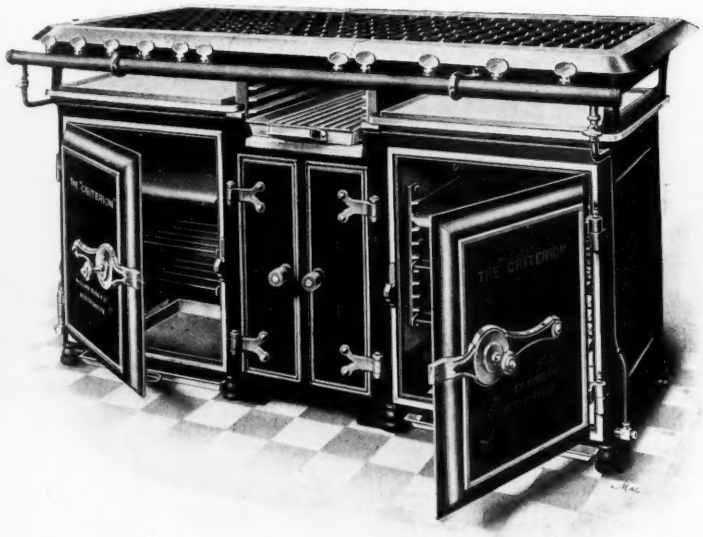

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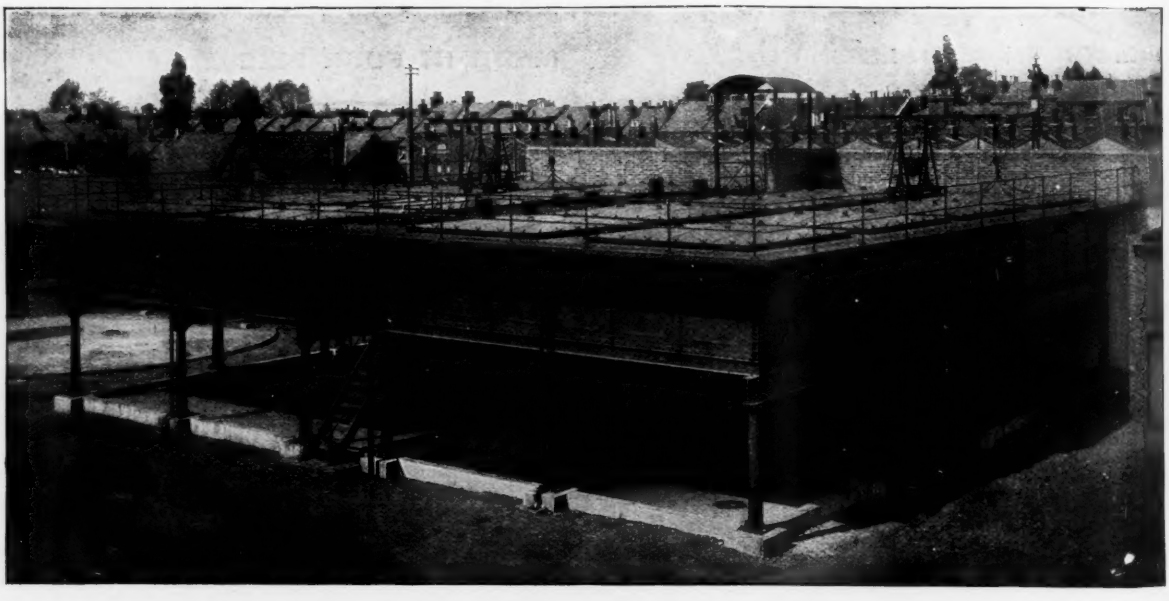

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STEAM-DRIVEN PUMPING PLANT FOR DEEP WELLS AND BOREHOLES.

By Alfred Towler, M.I.Mech.E.

[Extracts from a Paper read before the Association of Water Engineers.]

At the summer meeting of the Association held in the Westminster Town Hall in the year 1897, the author had the honour of reading a paper on pumping machinery—dealing on that occasion with an engine located within suction distance of its water supply. This engine (Aubrey Street, Liverpool Corporation Water-Works) was the first of the triple-expansion, vertical, three-crank type built by the makers. But, as proving the value of the improvements which have resulted from the experience gained, it may be mentioned that whereas the mechanical efficiency of the engine referred to was 86·8 per cent. on a lift of 102 feet, and the duty was 134 million foot-pounds per 1000 lbs. of saturated steam at 133 lbs. pressure above atmosphere (based on pump displacement at a speed of 34 revolutions per minute), the best of the four engines supplied to the Rand Water Board, South Africa, and tested by Professor Orr in 1908, gave a mechanical efficiency of 93·4 per cent. on a lift of 960 feet, and a duty of 183 million foot-pounds per 1000 lbs. of steam at 183 lbs. pressure above atmosphere, superheated to 120° Fahr. (based on water actually delivered at a speed of 41 revolutions per minute), and which result constitutes the world's record for minimum steam consumption against water delivered.

Even allowing for the increased steam pressure, the great head pumped against, the number of revolutions, and the amount of superheat, the author ventures to submit that these results show very satisfactory progress during the interval of eleven years. He now proposes to consider the class of plant in which the engine is out of suction distance from the water to be pumped; the pumps therefore requiring to be so placed as to allow of the level of the water receding when pumped, and being located some distance below the engine. As this type of pump requires to be actuated from the engine by rods, the name "rod pump" is sometimes applied. Such pumps may be placed in either deep wells or boreholes, and whether a well or borehole, or a combination of the two, should be employed depends, or should depend, upon: (*a*) The depth the water is lowered by pumping; and (*b*) whether the strata yield water freely. Borehole pumps must be of the bucket type; whereas well pumps may be of the ram type if the water level does not vary more than 24 feet. The latter type of pump must be fixed above the highest water level; while the former can be immersed in the water to almost any depth. The author is of opinion that water for domestic use may be pumped from a maximum depth of 500 feet below the point of delivery in one lift from a well or borehole; but in current practice 300 feet is seldom exceeded. It will be understood that, the other conditions being equal, the wear and tear of working barrels and bucket rings varies in proportion to the effective lift. If the lift is considerable, it is usually advisable to break it into two lifts, either at the surface or immediately above the highest water level; the upper or forcing pump being either of the ram or piston type.

The speed of the pumping is governed by the clear waterway available, the type of valves employed, and the length of stroke adopted. In force pumps, the water-way is unlimited, as the valves are exterior to the working barrel. If the pump is of the piston type, the diameter of the working barrel determines in a measure the water-way; but if of the ram or plunger type, the pump-case and clack-box may be constructed so as to give any desired water-way. It will, therefore, be apparent that such pumps may be run at considerable speed, particularly where they are located near to the engine and coupled directly to it. On the other hand, in bucket pumps, such as are employed in deep wells and boreholes, the valves are either within, or are required to pass through, the working barrel; and the water-way being therefore limited, a slower speed and preferably a long stroke are necessitated.

The mechanics of pump construction being somewhat beyond the scope of this paper, the author will confine himself to indicating the principles which, in his opinion, affect the durability and efficiency of rod pumps. The valves should offer a minimum amount of resistance with a maximum water-way, and at the same time be sensitive, quiet in action, and remain tight when closed. With regard to bucket leakage, it is sometimes argued that no rings or packing are necessary if the bucket is deep, is turned a good fit in the working barrel, and furnished with a number of grooves; that rings are a nuisance and sometimes jam, and are liable to be damaged in passing the pump tree joints. In the author's opinion, it is not commercially practicable to make a working fit such as is in this case required. In bucket pumps furnished with a good form of packing, the author has found that an allowance of 5 per cent. for slip is ample to cover all leakage. In rod pumps the moving parts should descend by their own weight, and not have to be forced down, otherwise buckling of the rods will take place; and if the rods are sufficiently guided to prevent this, abnormal wear and tear will be caused.

The capacity of any pump in which the working barrel is immersed below the surface of the water is increased by the head on the under side of the suction valve or clack—that is, as the water more readily follows the bucket, it may be run at a greater speed. But the normal capacity of such pumps should be calculated without allowing for such "suction head;" and the water level should be taken from the centre of the working barrel. In what is sometimes called the "concertina" pump, two buckets are actuated in one working barrel by two sets of rods—one bucket ascending while the other is descending. It is claimed for this type of pump (1) that it has a greater capacity than a single-acting bucket pump, with the same diameter of working barrel; (2) that no live load is put upon the working barrel or pump trees; and (3) that a considerable saving in first cost is secured. The author is of opinion that no material increase in capacity can be obtained without abnormal wear and tear; and the great objection to this type of pump is the velocity of the water through the valves, due to the fact that the top bucket, when descending, meets an ascending column of water actuated by the lower bucket. The wear and tear of such pumps is often excessive, and slip is probably greater than in the older form, due to the running joints being doubled. With respect to first cost, the "concertina" type of bucket pump has a decided advantage as regards capacity for any given diameter of working barrel; but this, as previously pointed out, is an unfair basis.

Having shown, from the point of view of pump construction, the advantages of a long stroke, and consequently a smaller number of strokes per minute, the author next considered questions arising from the point of view of engine construction, and said that the least expensive, and, in his opinion, the most suitable, method of operating direct-acting long-stroke force and deep well or borehole pumps was by a non-rotative engine of the type of the Davey horizontal tandem triple-expansion surface condensing engine. When first cost was an important consideration, and coal was cheap, the non-rotative type of pumping engine took a great deal of beating. The improvements made in this type of pumping engine are shown by the following facts: A compound high duty pumping-engine made for, and tested by, Mr. Isaac Carr, M.Inst.C.E., at the Netherley Pumping-Station of the Widnes Water-Works in 1893, gave a duty of 109 million foot-pounds per 1000 lbs. of saturated steam at 75 lbs. pressure per square inch above atmosphere, calculated on pump displacement; the water horse power being 200. This was thought at the time to be a very excellent result; but last year (1908) a similar engine installed at the Stocks Well Pumping-Station belonging to the same Corporation, and tested by Mr. Carr, gave a duty of 143 million foot-pounds per 1000 lbs. of steam at 175 lbs. pressure above atmosphere, superheated 81° Fahr., calculated on pump displacement—the water horse power in this case being 410. The following is a description of this plant, and an account of its duty trial, with results in detail.

Stocks Well Extension of the Widnes Water-Works.

The pumping-engine was specified by Mr. Isaac Carr to pump 3 million gallons of water in 24 hours from a depth of 250 feet to the surface and thence into the service reservoir at Pex Hill, a distance of two miles, and 150 feet above the ground level at Stocks Well, *plus* an allowance for pipe friction of 100 feet, making a total lift of 500 feet; the working boiler pressure was to be 180 lbs. above atmosphere, superheated 50° Fahr. at the engine stop-valve.

The Contractors gave a guarantee of 128 million foot-pounds per 1008 lbs. of steam discharged from the air-pump and jackets; this duty being calculated on the pump displacement, and subject to a "premium and penalty clause,"

by which the makers agreed to forfeit £40 per million foot-pounds should the duty fall short of the amount guaranteed, and were to receive a premium of £20 per million foot-pounds should the guarantee be exceeded.

The contract for the steam-generating plant was let separately, and included: Two Lancashire boilers, 30 feet long by 8 feet in diameter; two Bolton's down-take superheaters, each having 47 square feet of heating surface; one of Carter's fuel economizers, with 32 pipes and 384 square feet of heating surface. The equipment of the pumping station included: One 10-ton hand travelling crane commanding the whole of the engine-house, a steam winch, together with 25-ton lifting tackle commanding both boreholes. The engine is of the horizontal, tandem, triple-expansion, surface condensing type. The force-pump is horizontal, of the double-acting piston type, and is worked from the tail rod of the low-pressure cylinder. The two borehole pumps are of the single-acting bucket type suspended in the boreholes, which are 22 feet apart. These pumps are actuated by connecting-rods operated from the high-pressure piston-rod by means of Davey's compensating lever motion; a high grade of expansion being thereby rendered possible.

The plant was started on May 6 last year, and was run continuously for a fortnight, pumping to waste until the water cleared. It was then run for another fortnight pumping into the mains, after which the temporary buckets were drawn and replaced by the permanent ones. The engine started under permanent work on June 3; on July 11 the preliminary test was made, and on July 13 the pumping-station was officially opened—the official duty test being made on Nov. 5. It was found, when the normal quantity of water was being pumped into the reservoir, that the friction in the delivery main was less than had been anticipated—namely, 57 feet; making a total working head on the force-pump of 207 feet. The rest level of the water in the boreholes was 70 feet; and when pumping at normal speed the water level receded to 122 feet below the surface. At the preliminary trial, a duty of 141 million foot-pounds per 1000 lbs. of steam at 168 lbs. pressure above atmosphere (superheated 50° Fahr.) at the engine stop-valve was obtained. This duty is based on the pump displacement, the steam used being measured from the air-pump discharge and the jacket drains.

The normal speed of the engine was 13·5 double strokes per minute; but it was found to work equally well at any speed between 12 and 18 double strokes. When it is working at normal speed, it will easily supply all the water required; so that the other pumping-station can be shut down, and used as a stand-by only. At the maximum rate of pumping, the level of water in the boreholes receded to 152 feet below the surface.

As the engine under normal conditions was somewhat lightly loaded, it was agreed that during the official test the delivery main should be throttled and the engine run at its maximum speed, so as to more nearly approximate to the conditions on which the guarantee was given—namely, a total lift of 500 feet. This offered no difficulty, and the fluctuations of pressure on the delivery water pressure-gauge were immaterial. No stroke recorder was available; but the length of stroke throughout the trial was kept under careful observation, and was found to be very uniform and as nearly as could be ascertained to the length specified.

Principal Dimensions.

Cylinders, 23 in., 38 in., and 60 in. diameter.
Two bucket (borehole) pumps, each 20 inches diameter.
Double-acting force-pump, 20 inches diameter.
Stroke of engine and pumps, 6 feet.
All piston rods 6 inches diameter, except the low-pressure cylinder back end and force-pump rod on the front side of piston, which were 4½ inches in diameter.

Results of Twelve-Hour Trial—Nov. 5, 1908—Conducted by Mr. Isaac Carr, M.Inst.C.E.

Steam pressure at engine	175·5 lbs.
Temperature of steam at engine	459° Fahr.
Superheat	81·5° „
Vacuum in condenser	28·4 inches.
Steam pressure in H.P. receiver	44·6 lbs.
Steam pressure in I.P. receiver	0·76 „
Total number of double strokes	12,340
Double strokes per minute	17·138
Indicated H.P. of H P. cylinder	160·37
Indicated H.P. of I.P. cylinder	172·87
Indicated H.P. of L.P. cylinder	157·76
Total I.H.P. of engine	491
Borehole gauge (*less* 11·16 feet)	151·56 feet.
Delivery gauge (*plus* 13·87 feet)	347·27 „
Horse power of borehole pumps	128·08
Horse power of force pump.	286·03
Horse power absorbed at gear.	3·45
Total pump-horse-power (*net*)	410·66
Mechanical efficiency	83·63 per cent.
Air pump discharge	61,611 lbs.
Mean temperature of discharge	76·8° Fahr.
Jacket drains.	6405 lbs.
Water supplied to vacuum spoiler	6 lbs.
Total steam used by engine	68,010 lbs.
Jacket steam per cent. of total.	9·41 per cent.
Steam used per hour	5667·5
Steam used per I.H.P. per hour	11·42 lbs.
Steam used per P.H.P. per hour.	13·8 lbs.
Duty of 1008 lbs. of steam	144,616,000 ft. lbs.
Duty of 1000 lbs. of steam	143,468,000 „ „

In conclusion, the author expressed his indebtedness and thanks to Mr. Carr for the following information received on the 2nd of May last, and said the members would no doubt join in congratulating Mr. Carr on obtaining such an abundant supply of good water so near the surface, and on the economies effected with the new pumping plant.

"We have this week taken out the buckets, and find that No. 1 borehole is silted up for a depth of 84 feet, the total depth being now 518 feet. The depth of No. 2 borehole is 678 feet; only 24 feet being silted up in this one. We take it the filling up with sand of No. 2 borehole has been prevented by a strong flow of water struck at the lower level.

"It is only necessary at present to run the plant for six days per week at normal speed; and when the plant is standing on Sundays, the rest water level is about 100 feet below the surface. When pumping, it recedes to 150 feet below the surface.

"The saving in the coal bill for the past twelve months is £1649 on the present contract price of 9s. 3d. per ton. This figure is about £650 in excess of the amount required to pay interest and sinking fund on the total outlay. As there is no pumping at Netherley, there is also a further saving in wages and maintenance charges of about £300 per annum.

"The whole of the water is now pumped by the new plant. The Netherley Station is shut down and only run occasionally to keep the machinery in order.

"The total capital outlay on the new extension was £16,600. The cost of the two boreholes was £2042. My estimate of the saving in the two boreholes as against the cost of sinking a well suitable for accommodating pumps to do the same work is £25,000. In making this estimate, I find myself face to face with some difficulty. In the first place, having regard to the existence of the number of boreholes at this station prior to the commencement of the work, together with the open nature of the strata, I am of opinion that it would have been a practical impossibility—I mean by this within the range of practical costs—to have sunk a well to such a depth at this station.

"The cost of pumping would itself have been such as would have rendered such a scheme prohibitive; so that had there been no other way of carrying out the work, another site would have been the only alternative. My estimate of the cost of a well, which would probably have had to have been not less than 16 feet diameter at the top and finishing up with not less than 10 feet at the bottom, would have cost, with the enormous temporary pumping, not less than the figure given. Of course, I am speaking of a well sunk in the new red sandstone formation of the heavy water-bearing quality such as is met with in this neighbourhood.

"Having regard to the fact that the Netherley Well, which is oval in shape, 12 feet by 9 feet, sunk only to a depth of 100 feet with a 24-inch borehole, a further depth of 200 feet, making a total depth from the surface of 300 feet, cost £8200, I think my estimate of £25,000 for a well 250 feet deep, having regard to the enormous extra pumping that would be required, is an extremely modest one.

"The cost per 1000 gallons of water delivered into Pex Hill Reservoir (working costs, without capital or sinking-fund charges) is 0·4d. The selling prices at Widnes are arranged on a sliding-scale, regulated by the quantity of water consumed, and are as follows: 4¼d per 1000 gallons to consumers up to 40 million gallons; 3¾d. per 1000 gallons for all consumed from 40 million to 50 million gallons; 2d. per 1000 gallons for all consumed above 50 million gallons.

"To many engineers the latter figure will appear to be a perfectly safe figure to offer to sell water at, as it is an exception for any water authority to have consumers taking so much per annum. As a matter of fact, however, in Widnes 28 per cent. of our total quantity used for manufacturing purposes is sold at 2d. per 1000 gallons.

"The charge for domestic supply is 4 per cent. on the net rateable value, inclusive of baths and water-closets."

Discussion.

Mr. F. J. Bancroft (Barnet) congratulated the author on the high duty obtained in the mechanical efficiency of 93·4

per cent. on a lift of 960 feet, and a duty of 183 million foot-pounds per 1000 lbs. of steam at 183 lbs. pressure. He thought this a very creditable performance. With respect to solid *v.* packed buckets, he had had experience of both solid buckets and those with rings, and was not prepared to condemn the former, as Mr. Towler had done. With reference to the respective merits of steam and gas driven plants, in a case he had in hand alternative tenders were invited, and it was ultimately determined, after careful consideration of the economy of steam and fuel, and also the cost of upkeep, to have steam-driven plant and direct-acting engines.

Mr. C. Liddell Simpson (London) described the paper as a very interesting one. He gathered that the author preferred large slow-running engines, driving pumps direct without the intervention of any sort of gear. Unfortunately, very often the efficiency of a large pumping installation was sacrificed in order to keep down the initial cost by having a cheaper design. Taking the case of the large horizontal engine described in the latter part of the paper, there was no doubt there would be difficulty in getting at the intermediate cylinders for examination, on account of the three cylinders being arranged in tandem. As to the steam distribution on the horizontal direct-acting engine working without a fly-wheel, it was very interesting to know that so good a steam distribution and economical result had been obtained. It must be attributed to the very heavy working parts, which had enabled the engine to cut off early, and at the same time maintain its stroke. The steam-jacket arrangement would have been better if it had been kept entirely separate, instead of only the high-pressure cylinder steam-jacket being kept separate. The "concertina" pump was mentioned in the paper. There were many cases where this form of deep-well pump was the only one that could be used. It took up little space, was self-balanced, and in the many examples of which he had experience this form of pump-work gave excellent results. On tests he had made, the slip had been found to be very small indeed; the highest recorded being 2½. It was well known that excellent results could be obtained with large engines which had small clearances, and made a fewer number of reciprocations.

Mr. H. Ashton Hill (Birmingham) said that the type of engine—horizontal, and requiring a long house—had been referred to by the author; but up to the present time he (Mr. Hill) had looked on this class of engine rather as being most suitable for borehole pumping. It seemed to lend itself to this work, in its motion, in the length of stroke, and in the free movement of the connecting-rods. He had recently put down such an engine; but instead of it being made direct-acting, he had added a fly-wheel to it. This met the view expressed by Mr. Simpson, who said he believed in large engines with long stroke and with small clearance; and no doubt this accounted for the considerable economy which they had obtained. The question of solid or packed buckets seemed to have assumed rather an important feature in the discussion. He did not believe in solid buckets, and would not have them in his works, except, perhaps, at the start of an engine, when they might possibly have sand to deal with. He knew that they would slip anything up to 30 per cent., or even more.

Mr. A. B. E. Blackburn (Sunderland) agreed that the direct-acting horizontal engine was the best in the case of pumping from deep boreholes. He was putting one down—a compound engine—and he could not say that he had yet been convinced that the greater economy of a triple-expansion engine really counterbalanced the increased initial outlay and upkeep involved in the extra length of building and the additional number of valves in the case of that engine. He did not quite understand the statement in the paper about an allowance being made for pipe friction of 100 feet, which seemed to him to be enormous.

Mr. J. J. Lackland (St. Helens) said the question of triple *v.* compound engines had, in course of time, proved to be very important; and triple-expansion engines had not yet shown conclusively that they were superior in regular work to compound engines for pumping. One reason for disappointment in pumping-engines was, he thought, that there was always a tendency—almost a certainty—that the engine would be designed too large for its ordinary work. He had had the pleasure of inspecting the new engine at Widnes; and he must congratulate the makers on it. In appearance, it was one of the finest engines he had seen; and it worked extremely smoothly and well, except in one small particular, which was not of much matter—namely, the slight knock which was caused by all the Corliss valves tripping together. It was always interesting to follow the performance of an engine over a series of years. In 1904 the duty of the Netherley engine at Widnes was given as 47½ million gallons, against 109 millions when the trials were first made. This showed a difference of two to one between regular work during twelve months, and the result in the trials.

Mr. J. Shaw (Boston) said he should like to refer to the "concertina" pump. The author stated in the paper that the great objection to this type of pump was the velocity of the water through the valves. He had had experience with such a pump—one of the first that was brought out—made by a Manchester firm in the early seventies. It was fixed in a well, where a set of three-throw pumps was already installed, and there was not room for a second set. The "concertina" pump was put in, with a peculiar motion, in which, by means of slots, the time of the bucket coming up was two-thirds of the revolution of the wheel. The bucket went down in half the time occupied in coming up. The suction water came twice as fast through the bucket when it was going down as the water travelled before the bucket when it was being brought up. There were two buckets in the one pipe, with a distance-piece between them. There were practically two pump-barrels; and it was claimed for it then—probably it would be now—that there was no stoppage or reversal of the water, but that it kept continually flowing in the one direction, and that by this arrangement the ascending bucket took the water before the other ceased to come down. He decided one day that he would endeavour to find out what was the difference in the pressure between the two buckets; and he came to the conclusion that what he might call the bugbear—the velocity of the water as a detriment to the pump—practically did not exist. There was certainly very little difference between the pressure when the upper bucket was going down and when the lower bucket was ascending; and there was practically no difference due to the head of the column of water in the pipe. There were some difficulties in regard to the pump, which had been removed in those constructed of late years; but he believed there were places in which the "concertina" pump would do good work at the present day.

Mr. Towler, in reply, said Mr. Bancroft had spoken of solid buckets. He (the speaker) would leave this for a moment, and return to it later on, when he was dealing with the same question which had been raised by one or two other speakers. Mr. Simpson had spoken of the difficulty of getting at the intermediate piston. There was really no difficulty in this particular design, because the piston-rod was made in three lengths, and each length was cottared up behind the piston, so that they could get out the whole of the parts. It was not at all a difficult operation. Mr. Simpson was very much in favour of solid buckets. He thought that to the views he had expressed in the paper in favour of buckets with rings he might add the words uttered by a very eminent statesman—Mr. Joseph Chamberlain: "What I have said, I have said." With regard to the "concertina" pump, he believed the greatest trouble that had occurred with the pump was in trying to force it. Some people had an idea that they could get as much water again out of a "concertina" pump as they could out of an ordinary one of equal bore. He did not for a moment mean to say that he was wedded to the older form of pump under all conditions; but he did say this—that a plain single-acting pump was, generally speaking, very much more efficient, and much more durable than "concertina" pumps as usually employed, because these pumps were, he thought, rather misused than otherwise. With respect to efficiency, he should like to explain that his experience was that an engine running at an ordinary speed of 40 revolutions per minute, would run, doing precisely the same work, more efficiently than the same engine going at 30 revolutions. He had proved this a number of times. Turning to Mr. Hill's remarks, he thought that the engine spoken of was built by his firm. As a rule, it was often said that they (the engine builders) obtained a good duty at the trial, and that then the engine became rather degenerate. The one to which Mr. Hill had referred was evidently an exception to the rule; and he did not see why any pumping-engine, produced by a good maker, should not come up, in ordinary running, to reasonably near the work done at the duty trial. Mr. Blackburn had spoken of the allowance of 100 feet for pipe friction. Of course, this friction was given by Mr. Carr in the specification which he issued to the different manufacturers to tender upon. They were not

responsible for that. Mr. Lackland was candid in his criticism; and he (Mr. Fowler) liked this. He mentioned the noise which the dash-pots made—all three falling at the same time. This was very objectionable. They did make a noise, as generally set; but they were fitted with shifting valves which could be set so that they made very little noise. Mr. Lackland also mentioned the question of triple *v.* compound engines. He thought that what he had already said would answer his question. With regard to an engine being too large for its work, there were two ways of looking at this. An engine might be too large, in the sense that it was able to pump twice the quantity of water it might have to do. Then there was the other way—that the head on the pumps might be very much less than had been originally intended. With steam-driven pumps, the water load might vary considerably without affecting the efficiency to a very great extent; but the engine was built for (say) 40 revolutions a minute, and it could only be worked down to 20. Of course, it could not be worked so economically at this rate as if it were running at its top speed. Then Mr. Lackland spoke about the reduced efficiency of engines in working, and referred to the Netherley and the Aubrey Street engines. He (Mr. Towler) was glad Mr. Lackland did mention these engines, for he could explain it to the members quite satisfactorily. Nearly all engine trials as they knew, were made on Welsh coal, or steam coal that was equivalent. In the case of the Netherley engine, it was taken on 1008 lbs. of steam equal to a coal with an actual evaporation of 9 to 1 in ordinary work. This was a very good kind of coal. After an engine had started, it suited the engineers very often to use local coal or common slack, which they could buy at a much cheaper rate. He thought the cost of the best Welsh coal, even at Liverpool, might be taken at 24s. or 26s. per ton. They might be using a coal of one-half or one-third of this value. So that, generally speaking, the figures of the ordinary working costs were on the cheapest coal that could be obtained. He hoped this explanation was quite clear and satisfactory. With regard to the Aubrey Street engine, he knew that its upkeep had been rather heavy; but he had it from the highest authority that the efficiency had been maintained. The engine was quite as efficient in steam consumption to-day as it was when it was first of all started eleven or twelve years ago. Mr. Shaw had spoken of the "concertina" pump. It was a physical impossibility to have one bucket going down and another coming up without an increase of speed of water through the buckets. If they were to run a pump of this sort, it might not be the top bucket which would give them trouble; it would probably be the bottom one. If they could not get water into the bucket, of course they could not pump; it was only a matter of degree. He thought anyone using a pump of this sort would find that a fast-running "concertina" pump would cost a good deal in the year.

The PRESIDENT (Mr. R. Askwith) said he was sure the members were much obliged to Mr. Towler for the clear way in which he illustrated his paper; and he ought to receive their thanks.

Daylight Saving Bill.—The Select Committee appointed to consider this Bill have issued their report, in which they recommend that, having regard to the great diversity of opinion existing upon the proposals of the promoters and to the grave doubts which have been expressed as to whether the objects of the measure can be attained by legislation without giving rise, in cases involving important interests, to serious inconvenience, the measure be not further proceeded with. They, however, record their appreciation of the efforts of those connected with the movement, and particularly of Mr. W. Willett, in the direction indicated in the title of the Bill, since, as a result, the hours of beginning and leaving off work have already been advanced in many cases.

Fruits of the Patent Act.—Mr. Harold Farmer, of the firm of Messrs. Leopold Farmer and Sons, through whose medium many of the foreign manufacturers have established themselves here under Mr. Lloyd-George's Patent Act, has given to a representative of the "Westminister Gazette" the following figures showing the great good already accomplished by the Act: Value of land and premises acquired, £130,650; amount expended upon the alterations, erection of buildings, and housing of working people, £180,750; amount expended upon plant, machinery, and the equipment of factories, £183,972—total capital outlay, £495,372. This is not all, for the value of annual assessment upon which local authorities will levy rates is £27,833. The foreign firms who have invested the above amount of capital in this country for the purpose of manufacturing articles they have patented under British law, number 24. Most of them are from Germany and America; but a few came from Holland and France.

RECENT ADVANCES IN PHYSICS.

The Seventy-Ninth Annual Meeting of the British Association for the Advancement of Science was opened in Winnipeg last Wednesday, when the President (Sir Joseph Thomson, Professor of Experimental Physics at Cambridge) delivered his Inaugural Address. In the course of it he dealt with the following subjects.

RECENT ADVANCES IN PHYSICS.

It has usually been the practice of the President of the Association to give some account of the progress made in the last few years in the branch of science which he has the honour to represent. The period which has elapsed since the Association last met in Canada has been one of almost unparalleled activity in many branches of physics, and many new and unsuspected properties of matter and electricity have been discovered. The history of this period affords a remarkable illustration of the effect which may be produced by a single discovery; for it is, I think, to the discovery of the Röntgen rays that we owe the rapidity of the progress which has recently been made in physics. A striking discovery like this acts much like the discovery of gold in a sparsely populated country; it attracts workers who come in the first place for the gold, but who may find that the country has other products, other charms, perhaps even more valuable than the gold itself. The country in which the gold was discovered in the case of the Röntgen rays was the department of physics dealing with the discharge of electricity through gases—a subject which, almost from the beginning of electrical science, had attracted a few enthusiastic workers, who felt convinced that the key to unlock the secret of electricity was to be found in a vacuum tube. Röntgen, in 1895, showed that when electricity passed through such a tube, the tube emitted rays which could pass through bodies opaque to ordinary light. It could, for example, pass through the flesh of the body and throw a shadow of the bones on a suitable screen. The fascination of this discovery attracted many workers to the subject of the discharge of electricity through gases, and led to great improvements in the instruments used in this type of research.

It is not, however, to the power of probing dark places, important though this is, that the influence of Röntgen rays on the progress of science has mainly been due. It is rather because these rays make gases, and, indeed, solids and liquids, through which they pass conductors of electricity. It is true that before the discovery of these rays other methods of making gases conductors were known; but none of these was so convenient for the purposes of accurate measurement. The study of gases exposed to Röntgen rays has revealed in such gases the presence of particles charged with electricity. Some of these particles are charged with positive, others with negative, electricity. The properties of these particles have been investigated. We know the charge they carry, the speed with which they move under an electric force, the rate at which the oppositely charged ones recombine; and these investigations have thrown a new light, not only on electricity, but also on the structure of matter. We know from these investigations that electricity, like matter, is molecular in structure, that just as a quantity of hydrogen is a collection of an immense number of small particles called molecules, so a charge of electricity is made up of a great number of small charges, each of a perfectly definite and known amount. Helmholtz said in 1880 that in his opinion the evidence in favour of the molecular constitution of electricity was even stronger than that in favour of the molecular constitution of matter. How much stronger is that evidence now, when we have measured the charge of the unit, and found it to be the same from whatever source the electricity is obtained. Nay, further, the molecular theory of matter is indebted to the molecular theory of electricity for the most accurate determination of its fundamental quantity—the number of molecules in any given quantity of an elementary substance.

The great advantage of the electrical methods for the study of the properties of matter is due to the fact that whenever a particle is electrified it is very easily identified, whereas an uncharged molecule is most elusive; and it is only when these are present in immense numbers that we are able to detect them. A very simple calculation will illustrate the difference in our power of detecting electrified and unelectrified molecules. The smallest quantity of unelectrified matter ever detected is probably that of neon, one of the inert gases of the atmosphere. Professor Strutt has shown that the amount of neon in 1-20th of a cubic centimetre of the air at ordinary pressures can be detected by the spectroscope. Sir William Ramsay estimates that the neon in the air only amounts to one part of neon in 100,000 parts of air; so that the neon in 1-20th of a cubic centimetre of air would only occupy, at atmospheric pressure, a volume of half-a-millionth of a cubic centimetre. When stated in this form, the quantity seems exceedingly small; but in this small volume there are about 10 million million molecules. The population of the earth is estimated at about 1500 millions; so that the smallest number of molecules of neon we can identify is about 7000 times the population of the earth. In other words, if we had no better test for the existence of a man than we have for that of an unelectrified molecule, we should come to the conclusion that the earth is uninhabited. Contrast this with our power of detecting electrified molecules. We can by the electrical method—even better by the cloud method of Mr. C. T. R. Wilson—detect the presence of three or four charged particles in a cubic centimetre.

Rutherford has shown that we can detect the presence of a single α particle. Now, the particle is a charged atom of helium. If this atom had been uncharged, we should have required more than a million million of them, instead of one, before we should have been able to detect them. We may, I think, conclude, since electrified particles can be studied with so much greater ease than unelectrified ones, that we shall obtain a knowledge of the ultimate structure of electricity before we arrive at a corresponding degree of certainty in regard to the structure of matter.

Structure of Electricity.

We have already made considerable progress in the task of discovering what the structure of electricity is. We have known for some time that of one kind of electricity—the negative; and a very interesting one it is. We know that negative electricity is made up of units, all of which are of the same kind; that these units are exceedingly small compared with even the smallest atom, for the mass of the unit is only 1-1700th part of the mass of an atom of hydrogen; that its radius is only 10^{-13} centimetre, and that these units—"corpuscles" as they have been called—can be obtained from all substances. The size of these corpuscles is on an altogether different scale from that of atoms; the volume of a corpuscle bears to that of the atom about the same relation as that of a speck of dust to the volume of this room. Under suitable conditions, they move at enormous speeds, which approach in some instances the velocity of light. The discovery of these corpuscles is an interesting example of the way Nature responds to the demands made upon her by mathematicians. Years before the discovery of corpuscles it had been shown by mathematical investigation that the mass of a body must be increased by a charge of electricity. This increase, however, is greater for small bodies than for large ones; and even bodies as small as atoms are hopelessly too large to show any appreciable effect. Thus the result seemed entirely academic. After a time corpuscles were discovered, and these are so much smaller than the atom that the increase in mass due to the charge becomes not merely appreciable, but so great that, as the experiments of Kaufmann and Bucherer have shown, the whole of the mass of the corpuscle arises from its charge.

We know a great deal about negative electricity. What do we know about positive electricity? Is positive electricity molecular in structure? Is it made up into units, each unit carrying a charge equal in magnitude, though opposite in sign, to that carried by a corpuscle? Does, or does not, this unit differ, in size and physical properties, very widely from the corpuscle? We know that by suitable processes we can get corpuscles out of any kind of matter, and that the corpuscles will be the same from whatever source they may be derived. Is a similar thing true for positive electricity? Can we get, for example, a positive unit from oxygen of the same kind as that we get from hydrogen? For my own part, I think the evidence is in favour of the view that we can, although the nature of the unit of positive electricity makes the proof much more difficult than for the negative unit. The investigations made on the unit of positive electricity show that it is of quite a different kind from the unit of negative, and that the mass of the negative unit is exceedingly small compared with any atom. The only positive units that up to the present have been detected are quite comparable in mass with the mass of an atom of hydrogen—in fact they seem equal to it. This makes it more difficult to be certain that the unit of positive electricity has been isolated, for we have to be on our guard against its being a much smaller body attached to the hydrogen atoms which happen to be present in the vessel.

If the positive units have a much greater mass than the negative ones, they ought not to be so easily deflected by magnetic forces when moving at equal speeds; and, in general, the insensibility of the positive particles to the influence of a magnet is very marked, though there are cases when the positive particles are much more readily deflected, and these have been interpreted as proving the existence of positive units comparable in mass with the negative ones. I have found, however, that in these cases the positive particles are moving very slowly, and that the ease with which they are deflected is due to the smallness of the velocity and not to that of the mass. It should, however, be noted that M. Jean Becquerel has observed in the absorption spectra of some minerals, and Professor Wood in the rotation of the plane of polarization by sodium vapour, effects which could be explained by the presence in the substances of positive units comparable in mass with corpuscles. This, however, is not the only explanation which can be given of these effects, and at present the smallest positive electrified particles of which we have direct experimental evidence have masses comparable with an atom of hydrogen.

Structure of Matter.

A knowledge of the mass and size of the two units of electricity, the positive and the negative, would give us the material for constructing what may be called a molecular theory of electricity, and would be a starting-point for a theory of the structure of matter; for the most natural view to take, as a provisional hypothesis, is that matter is just a collection of positive and negative units of electricity, and that the forces which hold atoms and molecules together, the properties which differentiate one kind of matter from another, all have their origin in the electrical forces exerted by positive and negative units of electricity, grouped together in different ways in the atoms of the different elements. As it would seem that the units of positive and negative electricity are of very different sizes, we must regard matter as a mixture containing systems of very different types; one type corresponding to the small corpuscle, the other to the large positive unit. Since the energy associated with a given charge is greater the smaller the body on which the charge is concentrated, the energy stored up in the negative corpuscles will be far greater than that stored up by the positive. The amount of energy which is stored up in ordinary matter in the form of the electrostatic potential energy of its corpuscles is, I think, not generally realized.

All substances give out corpuscles, so that we may assume that each atom of a substance contains at least one corpuscle. From the size and the charge on the corpuscle, both of which are known, we find that each corpuscle has 8×10^{-7} ergs of energy. This is on the supposition that the usual expressions for the energy of a charged body hold when, as in the case of a corpuscle, the charge is reduced to one unit. Now, in one gramme of hydrogen there are about 6×10^{23} atoms; so if there is only one corpuscle in each atom, the energy due to the corpuscles in a gramme of hydrogen would be 48×10^{16} ergs, or 11×10^{9} calories. This is more than seven times the heat developed by a gramme of radium, or than that developed by the burning of 5 tons of coal. Thus we see that even ordinary matter contains enormous stores of energy. This energy is fortunately kept fast bound by the corpuscles; if at any time an appreciable fraction were to get free, the earth would explode and become a gaseous nebula.

The matter of which I have been speaking so far is the material which builds up the earth, the sun, and the stars—the matter studied by the chemist, and which he can represent by a formula. This matter occupies, however, but an insignificant fraction of the universe, it forms but minute islands in the great ocean of the ether, the substance with which the whole universe is filled.

The President proceeded to consider at length the subject of the ether, and then passed on to deal with radio-activity, the theory of radio-active change, and the source of radio-active energy, and the properties of radium; concluding his address as follows: The new discoveries made in physics in the last few years, and the ideas and potentialities suggested by them, have had an effect upon the workers in that subject akin to that produced in literature by the Renaissance. Enthusiasm has been quickened, and there is a hopeful, youthful, perhaps exuberant spirit abroad which leads men to make with confidence experiments which would have been thought fantastic twenty years ago. It has quite dispelled the pessimistic feeling, not uncommon at that time, that all the interesting things had been discovered, and all that was left was to alter a decimal or two in some physical constant. There never was any justification for this feeling; there never were any signs of an approach to finality in science. The sum of knowledge is at present, at any rate, a diverging, not a converging, series. As we conquer peak after peak, we see in front of us regions full of interest and beauty; but we do not see our goal, we do not see the horizon. In the distance tower still higher peaks, which will yield to those who ascend them still wider prospects, and deepen the feeling, whose truth is emphasized by every advance in science, that "Great are the works of the Lord."

CHEMISTRY AND ENGINEERING.

The President of the Chemistry Section of the British Association (Professor H. E. Armstrong), in the course of a long address, dealt with the following subjects of interest to our readers.

The Value of Chemistry.

The educational value of chemistry might be set very high. If properly taught, it would afford a means superior to all others of training faculties which in these days should be developed in every responsible citizen. No other subject lent itself so effectively as a means of developing the experimental attitude of mind—the attitude of working with a clearly conceived purpose to a desired end—which was so necessary to success in these days; and if care were taken to inculcate habits of neatness and precision and of absolute truthfulness, to teach what constituted evidence, the moral value of such work was incalculable. But to be effective it must be done under proper conditions, systematically; the time devoted to the work must be adequate. He would even advocate that the subject should be allowed to come before conventional geography and history and other unpractical subjects, assuming that the training was given in a practical way and with practical objects in view, not in the form of mere lessons learnt by rote. If taught in the form of mere didactic lessons, it was as worthless as any other subject as mental discipline.

When studied as a special object, chemistry, in particular, was one of the subjects which must be worked at long and persistently. Mere technical skill counted for so much, and so few seemed to possess the ability to become skilful chemists. In no other science did the element of understanding and an indefinable power of appreciating the character of changes as they occur, play so conspicuous a part; in no other science was the faculty of judgment more necessary. In practice, the chemist in works was constantly called upon to exercise his judgment—only too often to judge from appearances of conditions which were deep-seated. He was everywhere the works physician, in fact. It was therefore necessary that he should be highly trained and thoroughly versed in the art of inquiry. Much had been said and

written of late on the subject of technical training, which was of value as bringing out the various points of view. The problem was a very difficult one, owing to the great number of interests to be considered, and more especially the very uneven, and often inferior, quality of the material to be trained.

The great danger of specialized technical training was the tendency to make it too narrow. Success in practice depended not merely on knowledge of subject, but also, if not mainly, on the possession of certain human qualities which were not usually developed in the technical school and which could not be tested by examination. It was undeniable that in England, for many years past, chemistry had suffered from the recognized fact that there had been little money in it. Parents had been led, therefore, to prefer other careers for their sons; and the subject had not secured its due proportion of intelligence, and was suffering in consequence. Too many of those who had entered works had had neither the intelligence nor—to speak plainly—the presence and manners required to secure confidence. Men of gentlemanly bearing and instincts, who had received thorough training in science, were urgently needed at the present time in many of our manufacturing establishments to take the place of foremen of the old type, who had learnt all they knew in the works, and whose conceptions necessarily lacked breadth.

Chemistry and Engineering.

Another direction in which an approach of interests was required was between chemist and engineer. The latter had too long occupied a dominant position in many works, and in not a few cases had done his utmost to exclude the chemist—apparently fearing his competition. The gas industry perhaps afforded the most striking illustration of the effects of such a policy. On the engineering side, it had been carried to a high pitch of perfection; but on the chemical side it had ever fallen, year after year, to a lower state. The quality of coal gas was such, especially since the withdrawal of the sulphur clauses from the Acts of Parliament by which the industry was regulated, that gas was almost unusable. Had not chemists entirely unconnected with the gas industry vastly improved the methods of burning it, gas would long since have fallen into disuse. The iron industry was an even more striking case. The appliances were wonderful examples of constructive skill; but the engineer was clearly nonplussed when he sought to understand the processes he nominally controlled. The chemist had been kept so closely confined to his bench in the laboratory that he had had no proper opportunity of studying the processes of manufacture systematically. No systematic study of steel had yet been made. Considering the magnitude of the industry and its importance, our knowledge of the subject was phenomenally slight. What we did know of the relation of strength and structure to composition was due to the pioneer labours of the late Dr. Sorby—an amateur unconnected with the industry—and to a fruitful conjunction of the labours of engineers and chemists outside the works, who, in self-protection, had tested the materials before use.

In Germany, the chemist and the engineer had been placed on an equality and required to work together, with results which were altogether satisfactory. We needed to adopt a similar practice. Any attempt to fuse the two into one would meet with failure. They were called upon to work from different points of view. They needed to be in sympathy and to understand one another; but their work was complementary. They would be wise in Canada if they selected no small number of their abler students—young men of promise physically as well as intellectually—and trained them as chemists. Of late years attention had been called from every side to the inconsiderate manner in which raw materials, especially coal, iron, and wood, were being used up in all civilized countries. It was difficult to interest the public in such a subject, as few could appreciate the consequences, owing to the general ignorance of science and to the existence of an optimistic belief in the power of scientific discovery. But nothing would compensate for the exhaustion of coal and iron supplies. The chemist and engineer would be required to help in effecting economies by improving present methods of treatment.

Increase in the Cost of Mantles in Germany.—The Union of Incandescent Mantle Makers of Berlin have announced that, in consequence of the taxation of mantles which comes into force on the 1st of October, there has been such an enormous demand created for the time being that the manufacture is attended by largely increased expenditure, owing to the cost of raw materials having been increased and to the necessity of working overtime. The Union have decided to raise the price of mantles.

Water-Works Directory and Statistics for 1909-10.—We have received from Messrs. Hazell, Watson, and Viney, Limited, the above-named work. This is the twenty-eighth edition; and the Editor, in his preface, says every effort has been made to bring the volume up to date, and furnish the fullest and most reliable information. There is a considerable increase in the number of undertakings of which particulars (which are very full) are given; and the contents include, as before, a list of Associations of Water Engineers and an index of officials. In the preparation of the volume, the Editor had the support of the Association of Water Engineers, who appreciated the value of general information relative to the water undertakings of the country. The book is got up in the same style as its immediate predecessors; and it is published at 10s. 6d. net.

AMMONIA RECOVERY IN GAS-WORKS.

By J. S. Ungar, of Chicago.

[A Paper read before the Wisconsin Gas Association.]

There still seems to be doubt in the minds of some managers of medium-sized gas-works whether it pays to trouble with the recovery of the ammonia in gas liquor. It may be that these gentlemen believe the savings effected would not compensate for the time they would have to give to this new departure, or it may be that they have paid more attention to reports from gas-works that have had trouble with ammonia recovery, owing to poorly designed apparatus or to poor management, than to the many instances of successful operation. The manufacture of coal gas, unfortunately, is still much dependent upon the rough man with the shovel, who is willing to do jobs which the man better trained mentally refuses to undertake. Naturally, the manager hesitates to introduce new methods of procedure that necessitate greater attention to details on the part of his men, when he has trouble already in making them attend properly to their duties, and when his foreman may tell him that any change is going to cause trouble. Excepting the works where the design or the size of apparatus is inadequate or out of date, these troubles, however, are more imaginary than real. This is proved by the profits from ammonia recovery in gas-works gasifying less than 3000 tons of coal a year. Ammonia recovery also improves the quality of the gas, as generally it will be better condensed and washed, and thereby, besides the ammonia, also about one-eighth of the sulphuretted hydrogen and the carbonic acid are removed. In addition, an ill-smelling and destructive waste product becomes harmless and made to yield a profit.

Troubles attending ammonia recovery may be divided into: (1) Troubles converting all the ammonia in the gas into a liquor of sufficient strength for economical distillation; (2) trouble with distilling apparatus; (3) troubles of supervision.

Troubles in Generating and Washing.—Generally speaking, the conditions favouring a production of a fluid and merchantable tar also produce a high yield of ammonia from the coal; and when the tar is fluid there is no particular difficulty in working the hydraulic main without any addition of fresh water or special pumping to keep the main in good condition. High temperatures in the retorts, in connection with small charges, cause the well-known troubles, especially if the mains are small or not provided with easily accessible cleaning openings. When the tar is removed in large lumps or in irregular quantities, other liquid must be added to replace the quantities taken out; and in small gas-works without ammonia recovery, this is often done by adding large quantities of fresh water. As such practice would be inadmissible with ammonia recovery, the best method is to collect the liquor from the hydraulic main into a separate tank, pump it over again into the hydraulic main, and, if necessary, pass it through a cooler to get the temperature down. To pump the liquor from the condensers and scrubbers into the hydraulic main will cause loss of the volatile ammonia, owing to the high temperature prevailing in the mains.

In spite of the frequent assertion that employing any excessive seal is the cause of all the hydraulic main troubles, some gas-works and coke-ovens find many advantages with deep seals and corresponding vacuum, because thereby the gas is washed better, helping out the other condensing and washing apparatus and producing a more fluid tar.

There is no doubt that the rotary scrubber, from the gas maker's standpoint, is the best apparatus for the removal of ammonia after the gas has been cooled in the condensers. For reasons of operation, however, it is not suited for small works; and tower scrubbers are usually employed, preferably in connection with an immersion washer of some kind. To get out all the ammonia, and in order to get sufficiently strong liquor, two scrubbers are necessary, with fresh water only entering the last scrubber, and ammoniacal liquor pumped over and over again into the first scrubber. Three gallons of fresh water introduced per 1000 cubic feet of gas should be sufficient, with properly designed flushing and spraying arrangement; and these, with the hygroscopic water in the coal, estimated at (say) 1·6 gallons per 1000 cubic feet, and a yield of ammonia of 5 lbs. per ton, will yield a 5-oz. liquor equal to 1¼ per cent. of ammonia. This strength, however, may not be obtainable, owing to insufficient condensing and scrubbing apparatus, and it will pay to use more fresh water and get the liquor of (say) 1 per cent. strength. This will cause more steam to be used in the ammonia distillation—say a fourth more, compared with liquor of 1¼ per cent. But, owing to plenty of cheap fuel around coal-gas works, it is better to use more steam than to allow a large portion of the ammonia to escape.

Troubles with Distilling Apparatus.—Owing to the natural disinclination of managers of gas-works to complicate the process of ammonia recovery, only apparatus for making crude concentrated liquor will be considered. Ammonia concentration is a simple process, and can be worked almost automatically, if provision be made to introduce the weak liquor, the milk of lime, and the steam in constant and suitable quantities. Unfortunately, in order to diminish the first cost, or from lack of knowledge, these conditions are not obtained, with the result that the process becomes a source of annoyance and disappointment. The temperature of the vapours, before they enter the apparatus for final condensation into concentrated liquor, determines the percentage

of ammonia in the finished product; and, in order to keep this temperature at the desired degree, the thermostatic control has of late been attached to ammonia stills with beneficial results. However, if the weak liquor and the milk of lime yet remain but in imperfect control there will be corresponding irregularities in the steam supply—causing either loss of ammonia in the waste or excessive consumption of steam.

A regular supply of weak liquor can be obtained by a constant hydraulic head, either by keeping the feed-tank always full to overflowing, or else by interposing between it and the ammonia still an auxiliary tank controlled by a float. As a further precaution, and in order always to see the rate at which the still is working, one German manufacturer instals a meter, made in the form of a tilting tank underneath the tank with the float. Instead of a meter, good practice is to use two feed-tanks, one of which is emptied while the other is being filled.

A new method for supplying a regular feed of milk of lime in a concentrated form has lately been developed, in which the milk of lime is kept in a stirred condition and injected into the still by means of compressed air. The lime is first slaked in an open tank, and then poured into a tank that can be closed air-tight, and provided with perforated pipes in the bottom, through which the air enters. A vertical pipe, with its lower end open, conducts the milk of lime from the closed tank to a valve operated by the compressed air that has previously passed through the milk of lime. The air, acting on a rubber diaphragm, keeps the valve closed until the piston, in a dash-pot or cataract filled with oil, in its descent (caused by gravity), releases a lever that acts on a little air-valve, and permits the air behind the diaphragm to escape, thereby opening the main valve. Upon opening the piston, the cataract is raised again, the lever locked in its previous position, and the air again admitted against the diaphragm, with the result that the main valve closes, after having remained open for a few seconds, until after the descent of the piston in the cataract. The operation is then repeated. The time between the openings is regulated by a small valve allowing the oil in the cataract to bye-pass from bottom to top of the piston at varying speed. As the main valve, when opening, always discharges the same amount of milk of lime, the quantity of lime introduced into the still is regulated by changing the time-intervals between openings. Thus, the same size of valve can be used for a great many different sizes of stills. If the valve were omitted, and an attempt made to regulate by a small opening, it would soon clog up with lime.

As the air keeps the milk of lime constantly stirred; and as the air pressure will force the liquid through the pipe and the valve with a rush in a comparatively large quantity at a time, it is believed that no other method has been devised which will handle the milk of lime in such a concentrated form with equal reliability. It is safe to say that this device would deliver a milk of lime from six to fifteen times stronger than is at present the case at most gas-works. Besides, it will deliver the lime in suitable and perfectly controllable quantities, whereas ordinarily the lime is introduced hap-hazard and irregularly. Even with stills that are arranged for lime introduction, the operation is often so annoying that lime is dispensed with, or only attempts are made to give the still a little lime once in a while.

Lime for taking out the fixed ammonia should always be used in connection with ammonia distillation from gas liquor, as, in the first place, the so-called fixed ammonia, averaging about 15 per cent. of the total ammonia, is worth saving; and, in the second place, there will be less trouble with salting of the distillate, owing to the proportion of pure ammonia liberated by the lime. Consequently, the percentage of ammonia in the concentrate should be made higher before there would be any danger of salting.

The usual practice, on which the contracts between the gas companies and the ammonia refineries are made, is to ship a concentrate containing 15 per cent. of ammonia. It is claimed that a stronger distillate will cause losses in ammonia owing to evaporation, and that a 15 per cent. product is about the limit of strength that the gas companies can make. This may be all right where the distance to be shipped is comparatively short, though it would seem that a product containing 15 per cent. of ammonia and about the same amount of impurities in the shape of carbonic acid and sulphur, which must be removed by the refiners, would be less valuable per pound of ammonia than a product containing up to 25 per cent. ammonia with most of the impurities eliminated. When the distance becomes great, the freight that can be saved by making a stronger liquor is considerable. Thus, the freight of a 25 per cent. liquor is 40 per cent. less per unit of ammonia as compared with a 15 per cent. liquor; and the freight of a 20 per cent. liquor 25 per cent. less. The coke-oven concerns have long understood this, and have been shipping a stronger liquor; and abroad most new stills are contracted for with a provision that the liquor to be made may be 25 per cent. without salting. This is accomplished through a system of preheating the weak liquor in its descent in the distilling apparatus with the waste heat and other heat from the distillation column up to a certain temperature at which most of the carbonic acid and the sulphuretted hydrogen are liberated; whereas the warm liquor has still a property of retaining the bulk of the ammonia. These gases passing upward are washed by the descending weak liquor, whereby the ammonia is absorbed again, the acid gases escaping into the atmosphere. The process is not difficult, and causes but slight complication of apparatus. Previously the same effect was accomplished by washing the vapours from the still in lime water; but by the process above described this expense for lime is avoided.

The capacities of the stills in gallons of weak liquor per hour vary considerably according to the construction. For instance, a 6-feet diameter still has a capacity of 2200 gallons per hour; a 4-feet diameter still, 800 gallons; another 4-feet diameter still, only 300 gallons; a 40-inch diameter still, 780 gallons; a 36-inch diameter still, 270 gallons; a 24-inch diameter still, 110 gallons. The capacity can be increased by deeper seals of the hoods causing stronger boiling, and by a condenser at the top of the still, from which the condensate returns to the still, thereby, so to speak, drying the vapours, as the water condensed has but little capacity to retain any ammonia at that temperature.

Many complaints are heard that ammonia stills are soon destroyed by the action of the vapours in the upper part of the still. Owing to the high percentage of carbonic acid and other acid gases that destroy iron, the hot vapours have a special destroying effect on the pure iron, such as soft steel and wrought iron, but will also, in time, disintegrate cast iron.

If the acid gases are removed from the liquor before entering the still proper, this destruction would not take place, as the ammonia has but little effect on iron, for which reason such removal ought to take place. However, stills can be made more durable if iron is avoided in the upper part as much as possible, and therefore it is good practice to use coils of lead in the cooler and condenser, through which the vapours pass, rather than condensing the vapours in iron vessels, cooled with lead coils containing the cooling water. There is less danger of stoppages from deposit of salt in the iron vessels than in the lead coils; but with automatic temperature control there is very little danger of further stoppage, formerly the bugbear in the distillation of ammonia.

Troubles of Supervision.—An ammonia still of modern design, and provision being made for taking care automatically of the weak liquor supply, the milk of lime, the steam supply, and the waste, as explained previously, will do away with the difficulties of supervision as far as the distillation is concerned. A separate man to take charge of the still is, therefore, unnecessary; and beyond giving the man a little additional reward or premium to look after the ammonia recovery in addition to his other duties, there need be no extra outlay for labour in connection therewith. The testing of the liquor in a small works would be done by the superintendent or foreman; and after the apparatus has been used for some time, and the whole process has adjusted itself to normal conditions, there need be very few chemical tests, but only purely mechanical operations that do not require any extra skill.

DESTRUCTION OF A WATER-GAS PLANT FAN.

Dr. Leybold, of the Hamburg Gas-Works, reports, in a recent number of the "Journal für Gasbeleuchtung," on an accident which was brought to his notice last year, by which the fan of a blue water-gas plant was blown to pieces and a workman was severely injured. The blast main connecting the fan with the generator was about 40 feet in length and 14 inches diameter, and provided with a valve at the generator end. When the generator was in action, the return of gas to the blast main was prevented by maintaining the air pressure in the latter so that even if the valve was accidentally opened, or was not tight, no appreciable amount of gas would enter the main. There was also in front of the valve a small vent-pipe leading to the open. When the accident occurred, the operator wished to stop the manufacture of gas because the holder was then full. He closed the steam-valve, opened the gas outlet-valve and the intermediate valve, and moved the air-valve a little way up and down, in order to allow the gas which had collected in the apparatus and the connections to escape through the stack-valve. He called at the same time to the engine men to stop the engine. Two minutes later he went into the engine-room and saw bluish smoke escaping from the fan. He shouted to the two workmen to get out of the building as quickly as possible, and was going away himself, but an explosion ensued immediately which knocked the men down and shattered the fan into small pieces.

The cause of the accident appears to have been that the engine, and consequently the blower, were stopped too soon, so that the valve on the air-blast main remained open for a moment after the fan had ceased running, and the mixture of gas and air formed therein was ignited from the generator. In order to avoid a recurrence of the accident, orders have been given that the operator in charge of the manufacture of gas shall himself stop the fan after he has finished gas making. This will prevent the fan, which is in another room, being stopped too soon. There have also been made on the blast main two large openings closed with impervious canvas to serve as safety-valves. Dr. Leybold hopes that the explanation of the cause of this explosion may help to prevent similar accidents occurring in future.

The Key Engineering Company, Limited, of 4, Queen Victoria Street, E.C., have issued a calculator or slide-rule by means of which the profit or loss resulting from the installation of large gas-engines may be readily ascertained. Examples are given with the calculator to show its use.

RECIPE FOR MAKING OXIDE OF IRON.

In the course of a paper, on "The Preparation of Purifying Materials and the Purification of Gas," read by Mr. C. F. Farmer, a Superintendent in the service of the Austin (Texas) Gas Company, at the last annual meeting of the South-Western Electric and Gas Association, he gave the following recipe, which he said had given entire satisfaction, for making oxide of iron: To 20 lbs. of clean cast-iron borings (the finer the better), use one bushel of soft pine shavings, or sawdust for shallow boxes; spread the shavings in a thin layer, and sprinkle the borings evenly over them, wetting the mass as the layers are spread. Repeat these layers until the desired quantity is prepared. (Wetting with brine will hasten the operation.) Then, with shovels, turn the mass until it is thoroughly mixed; make a pile of it, and let it stand for 10 or 12 hours, when the oxide should be very hot; then turn it into another pile, wetting it down as before. Care should be taken not to get it too wet. This operation will have to be repeated every 12 hours for four or five days; then once in 24 hours should be sufficient, as the oxide now heats more slowly. When it does not heat after being turned, it should be spread in a thin layer, about 12 or 14 inches deep, and allowed to stand until wanted for the purifiers.

Mr. Farmer pointed out that new oxide will not purify as much gas when it is first used as it will after it has been worked a couple of times; and he said it should be watched very closely when in use. When it shows foul in the box, it should be taken out and heaped in a pile, which should begin to heat at once, and in 10 or 12 hours' time should be hot enough to burn one's hand if thrust into it. It should then be spread in layers 18 inches deep, left for 24 hours, then turned in layers 12 inches deep, and left until wanted again. Mr. Farmer added that, in making oxide, care should be taken not to leave any free iron in it, and not to let it come in contact with any wordwork, either in making or revivifying it, as it is liable to fire the oxide, char the wood, and ruin the oxide. Care should be taken to keep tar and oil from it, as both destroy its usefulness. In charging the purifiers with the oxide, it should be sprinkled with water to damp it, but should not be made too wet—just wet enough to stick together when squeezed in the hand, as too much wetting would cause it to cake and become hard in the boxes, making it very difficult to remove again when foul.

AMERICAN ILLUMINATING ENGINEERING SOCIETY.

The third annual convention of this Society will be held in the United Engineering Societies' Building, New York, from the 27th to the 29th of September. The proceedings will open on the afternoon of the first-named day with an address of welcome by Mr. T. Cummerford Martin, which will be responded to by Mr. Walton Clark. Then the President (Mr. W. H. Gartley) will deliver his address, at the close of which the reports of Committees will be presented; one being "On Nomenclature and Standards," by Dr. A. C. Humphreys, the Chairman. In the evening there will be a reception and concert. The following papers are being prepared for presentation and discussion:—

- "Ethics of Illuminating Engineering," by Mr. E. L. Elliott.
- "Some Notes on Illuminating Engineering Practice in Europe," by Mr. H. Thurston Owens.
- "The Importance of Illuminometry in Practical Illuminating Engineering," by Mr. Norman MacBeth.
- "Efficiency of Lighting Installations," by Mr. A. L. Eustace.
- "Shades and Reflectors," by Dr. Louis Bell.
- "The Design of Reflectors," by Mr. A. J. Sweet.
- "Diffusing Mediums," by Mr. A. J. Marshall.
- "Absorption and Diffusion of Various Forms of Glass Surfaces," by Mr. Basset Jones, jun.
- "Factory and Mill Lighting," by Mr. L. B. Marks.
- "The Photometric Laboratory of the United Gas Improvement Company," by Mr. C. O. Bond.
- "The New Physical Laboratory of the National Electric Lamp Association," by Mr. E. B. Hyde.
- "Modern Photometric Practice in an Incandescent Electric Lamp Factory," by Mr. Charles Deshler.
- "The Problem of Heterochrome Photometry," by Mr. E. S. Millar.
- "Description of a Demonstration Lighting Installation," by Mr. W. C. Morris.
- "Discussion of the Efficiency of the Moore Light," by Messrs. Hyde, Woodwell, Sharp, and Millar.

The exhibition feature of the convention, which was so successfully introduced last year, will be extended in scope. The Committee have secured the use of a building situated about midway between Fifth Avenue and the Illuminating Engineering Societies' Building, admirably adapted for the purpose; and on it a historical and educational exhibit will be arranged under the direct auspices of the Exhibition Committee. In addition to this, there will be exhibits by the manufacturers of the various commercial types of electric and gas lamps, accessories, and fixtures. The exhibition will be especially valuable as containing a number of the latest developments in the production and utilization of light, which have not been heretofore publicly exhibited. It will be open to the public during the entire week of the meeting.

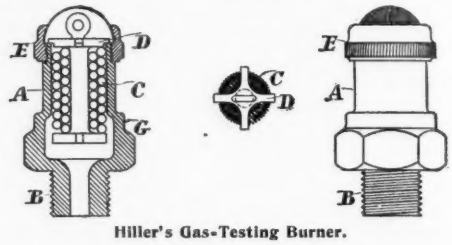
REGISTER OF PATENTS.

Gas-Testing Burner for Producer-Gas Plants.

HILLER, E. G., and the NATIONAL BOILER AND GENERAL INSURANCE COMPANY, LIMITED, of Manchester.

No. 16,157; July 30, 1908.

This invention relates to a device for keeping the wire gauze on producer power-gas plant test-taps always clean and ready for use, by providing on the nozzle that carries the wire gauze a cleansing-chamber, filled with layers of coiled wire wound on a bobbin for extracting the tar, moisture, or other foreign matter from the gas before it reaches the wire gauze.



Hiller's Gas-Testing Burner.

The cylindrical cleansing-chamber A (screwed into the gas-test tap at B) is bored out parallel to accommodate the bobbin, which is wound full up with two or more layers of non-corrosive coiled wire C. The flanges of the bobbin are of cruciform shape, as shown; the top flange D being larger than the bore of the casing, so that the bobbin is held in the proper position by the flange resting on the top of the casing. The whole is enclosed by screwed cap E, into which is fixed the wire gauze. The cleansing medium is removed at times for cleaning by unscrewing the top cap and withdrawing the bobbin.

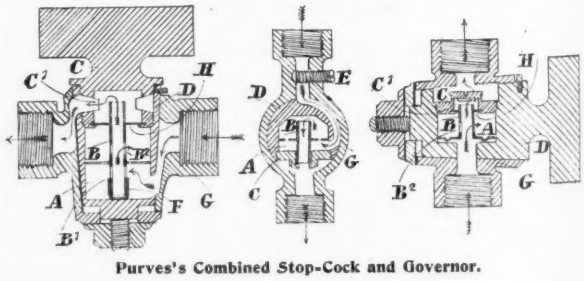
When these burners are used on suction power gas-plants where the internal pressure is below the atmospheric pressure, the burner acts as a preventative against explosion if a light is applied to the burner when the engine is at work; the construction of the burner being such that it prevents the flame being sucked into contact with the gases below the cleansing-chamber.

Combined Stop-Cock and Regulator or Governor for Gas.

PURVES, T. H., of Leith, N.B.

No. 18,091; Aug. 28, 1908.

This combination of mechanism, to work in unison, provides: Firstly, for manipulating and modifying gas stop-cocks, which act in the usual way, shutting off and on when required, and having the usual conical shaped shell or barrel with conical shaped plug let in and ground into the shell or barrel, and made gas-tight and connected together in the usual way by nut and washer. And, secondly, by forming smooth cylindrical chambers of suitable sizes and in proportion to the size of the stop-cock, the plugs of which contain automatic gas-governors to regulate the required quantities of gas passing into and through the stop-cock and governor, and thence by an outlet end into the delivery pipe. A movable piston or disc, having a tube fixed centrally in it, works easily up and down in the chamber; the gas acting upon it from the under side, while the upper end of the tube acts as a valve when it reaches its highest point by striking up against the top of a small chamber or recess in a cover through which it enters centrally, as at H.



Purves's Combined Stop-Cock and Governor.

In the three modifications shown, A is the chamber wherein the disc works up and down; B, the disc; B^1, the orifice or inlet for gas into the tube of the disc; B^2, the orifice in tube above the disc, to allow part of the inlet gas to enter and form a cushion of gas on the upper side of the disc. C is the screwed cover, wherein the upper end of the disc-tube enters; and C^1, one of two slots into the side of the screwed cover for the gas to pass out through the stop-cock after coming through the disc-tube. D is the plug containing the governor; E, the shutting-off screw; F, the sliding ferrule; G, the barrel of the stop-cock; and H, a disc of thin brass with a hole in the centre for the tube of the disc to work in easily. The cover C is screwed into the top of the chamber A, excepting in the second modification (for a downward flow of gas) where the chamber is inverted, and the cover is screwed in from the under side. The tube is supported by a narrow ledge at the bottom of the central hole in the screwed cover C; the gas entering by a side passage and passing through small holes in the disc B, and thence down the centre tube of the disc to the burner—an extra pressure of gas lifting the disc where it shuts off against the horizontal top of the inverted chamber A. The covers C have short projecting ledges, to

engage with and fit the mouth of the chambers A, for the purpose of keeping both parts true and central with each other.

In the second and third modifications the top of the covers C are milled for screwing in with the fingers, or slotted for a screw-driver, and lateral openings are made for the exit of the gas at C^1.

Gas only has access to the governor when the plug is turned on, and when the lateral openings in the plug for its admission and exit are in line with, and meeting, the inlet and outlet channels of the stop-cock.

In the first arrangement, the tube is fitted with a short sliding ferrule, to regulate the supply to the required quantity by partly closing the hole in the tube. The tube of the disc is bell-mouthed at the bottom to keep on the ferrule, and is solid at the under end.

Gas-Stoves.

BORDEREL, J., of Paris.

No. 20,046; Sept. 23, 1908.

This invention relates to stoves to be heated internally by gas, constructed in such a manner that the combustion of the gas is "complete" and that there will be "no production of noxious gases caused by an incomplete combustion."

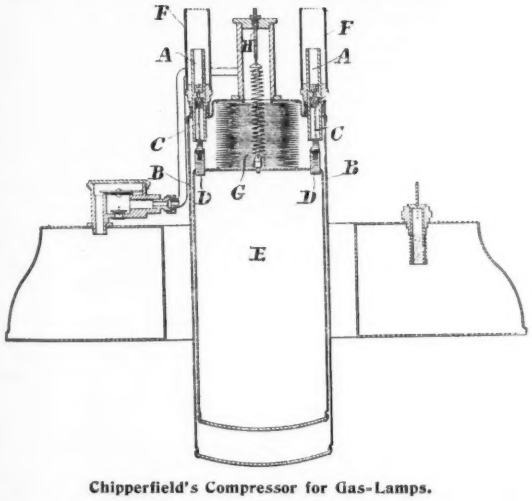
Gas-stoves are, of course, already known in which the draught is effected by the aid of cylindrical chimneys with a conical or cylindrical extension towards the base. But these chimneys have hitherto been constructed in such a manner that either the air is drawn in at a great speed, which does not give it time to mix properly with the gas, or in other cases (by reason of too abrupt alterations of section) eddy-currents are produced, which act injuriously on the complete combustion of the gas. In the gas-stove according to the present invention, the burner is completely enclosed by a chimney formed of a cylindrical part rising above the burner, and of a tapering part extending downwards, resting upon the base-plate close to the outer casing of the stove, in such a manner as to bring to the burner-flame a large quantity of air, which ascends at a very slow speed and without eddies so as to secure the complete combustion of the gas.

Compressing Gas or Air for Lamps.

CHIPPERFIELD, W. H., of Hanway Street, N.W.

No. 25,019; Nov. 20, 1908.

This invention has reference to apparatus of the type described in patent No. 20,521 of 1906—a cylindrical slide-valve attached to the outer vessel or chamber, the ports of which valve are open to the atmosphere at each end of the stroke; the downward movement of the valve being ensured by an arm mounted on a rod connected to the inner hollow body or displacer, such arm rising and falling with it, and the upward movement being effected by the rising of the inner hollow body. The present invention avoids the use of the arm extending above the slide-valve, to ensure its downward movement, and the use of the connecting rod by which the arm is operated; obviates the entrance of any dust, &c., in or around the slide-valve; reduces any noise resulting from the exhaust of the expanded air, and the intake of a fresh supply from the atmosphere; and renders the working parts of the apparatus more adjustable or removable for the purposes of inspection.



Chipperfield's Compressor for Gas-Lamps.

The illustration shows (sectional elevation) the operating mechanism of a high-pressure gas-lamp, together with the reservoir connected with it. A hollow, cylindrical slide-valve A is provided at (preferably) both sides of the top or cover of the outer vessel B. The valve is open at each end, and closed at its centre by a partition. The exhaust and intake openings are placed in the walls of the cylinder—respectively below and above the division. To the under side of the central division is connected a rod C, having at its lower end a link and screw, which takes into a correspondingly threaded recess in a stud D attached to the inner hollow body E. The screw-threaded recess is of inverted cone shape, to ensure the ready entrance of the screw attached to the lower end of the connecting rod. By these means, reciprocating motion is imparted to the slide-valve A by the rise and fall of the inner hollow body E. To the upper portion of the collar or sleeve, through which the valve works, is fitted a hollow cylindrical cover F—its upper end extending beyond the limit of the upward stroke of the valve, and has a gauze covering to deaden the sound and prevent the entrance of any foreign matter.

Instead of the weight of the inner hollow body or displacer E, and the hollow, flexible, extensible, and compressible metallic body G, being held in suspension by a spring and supporting rod, as described in the earlier patent, the top of the displacer is connected, through the medium of a spiral spring, to a screw rod H, which passes through an opening in the top of a removable cover supported by the central upper end of the outer chamber B. A screw-nut on the outer end of the rod, renders it capable of adjustment as required.

The working parts are thus more free to perform their functions, consequent upon the reduction of friction, and are less subject to wear—resulting in a more perfect closing of the body G, "by reason of the prevention of the escape of any air or gas around the reciprocating piston rod, as heretofore employed, and the compressing apparatus is rendered more sensitive and positive in its action."

Pyrophorus Substances for Ignition and Illumination.

LESMÜLLER, A., of München, Bavaria.

No. 27,341; Dec. 16, 1908.

This invention relates to the production of pyrophorus substances to be used for ignition and illumination.

The patentee points out that the metals of the rare earths are distinguished by considerable heat of combustion and low ignition temperature. If scratched with harder metals, small particles of the metal become detached and burn immediately—developing considerable heat and radiating intense light. The pure earth-metals possess this property to a very high degree; but as they are too soft, and oxidize too easily, they are not suitable for technical purposes. It is therefore necessary that they should be mixed with other substances in order that as small sparks as possible should be emitted. This reduces the consumption of the rarer metal to the lowest limit; the substances admixed being, of course, harder and less subject to oxidation than the metals of the rare earths. To this end, it has been proposed to alloy the rare earth-metals (by an electrolytic process) with other harder metals or a metal—such as iron for example; and it has further been proposed to add silicium to an alloy so formed. But the effect of the addition of the heavy metals to the rare earth-metals is to very considerably reduce the heat of combustion of the latter.

Now in the course of his experiments, the inventor says he has discovered that if, in place of metals, metalloids—such as silicium, titanium, or boron—are added to the rare earth-metals, a substance is produced which is very hard, economical in use, less subject to oxidation, and of much greater durability when exposed to the atmosphere than is otherwise the case. The temperature of ignition of such metal compounds is very low; so that if rubbed against a harder body, small particles are detached which inflame at once in the open air, and are adapted for igniting combustible gases, and even solid combustible substances.

If suitable oxidizing substances—for instance, potassium chloride, potassium permanganate, manganese dioxide, the super oxides of barium, magnesium, or zinc or chromates, dichromates, and persulphates—be admixed with the pyrophorous compounds, they can be used advantageously in a pulverized state for the production of flash-lights, lighting-compositions, and the like.

The combinations of the metals can be obtained by various methods: (1) The metals of the rare earths may be electrolytically separated, for example, from mixtures of chlorides or fluoride-oxides; and after the electrolysis, the silicium, titanium, or boron is mixed with the solution. The bad conductivity of the electrolytes thus produced has to be overcome by means of very high potentials, to avoid the congelation of the metal in fusion during the period of combination. (2) A simpler method would be to melt down the metals of the rare earths in a suitable crucible—for example, in a magnesia-crucible—and under a cover of molten salts (such as sodium-chloride, potassium-chloride, or chloride of barium) to exclude the air, whereupon the silicium, titanium, or boron is added. (3) The metals of the rare earths may be melted in a jet of indifferent gases, or even directly in a vacuum; the silicium, titanium, or boron being simultaneously added.

Lighting and Extinguishing Gas-Lamp Burners.

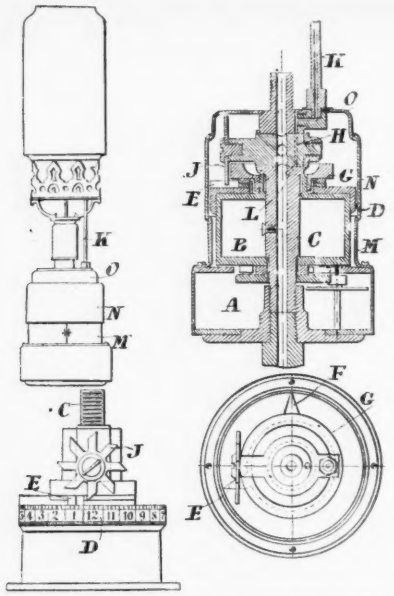
GOUNEVITCH, E. DE, of Paris.

No. 5117; March 2, 1909. Date claimed under International Convention, March 18, 1908.

This device, for bringing about the automatic lighting and extinguishing of gas-burners at given hours which can be altered, is illustrated by a whole burner provided with the device, an enlargement of the top part of the lighting and extinguishing device, a vertical section of the device, and a plan of it.

The device comprises clockwork A (only one movable wheel of which is shown on p. 584). The spring (not shown) operating the clockwork is arranged in the barrel B, the spindle C of which is constituted by the conduit used for the passage of the gas going to the burner. The circumference of the barrel is provided with a dial D divided into 24 hours—12 hours for the day and 12 hours for the night. On the upper face of the barrel are arranged two hands E F secured to, and rendered solid with, the barrel by a nut which, nevertheless, on being unscrewed, enables the hands to be moved independently of each other. One of the hands, in fact, indicates on the dial the hour for opening the burner; the other, the hour for closing. The hours can be changed by shifting the hands as explained.

The gas-conduit C and the clockwork are fixed or stationary, while the barrel B revolves about it. On the conduit is mounted a cock H provided with two holes at an angle of 90°. The plug of the cock is constituted by a star J with eight arms, four of which correspond to the openings and intersect each other, while the other four are the intermediate branches. The star is arranged in such a manner that the branch which is in the low position meets the hands E F rotating with the barrel. The dial is regulated so that the figure on it passing to the right of the bottom branch of the star indicates the exact hour. A bye-pass K, receiving its gas at L from the conduit C in front of the cock, is always alight when the burner is extinguished.



De Gounevitch's Lamp Lighter and Extinguisher.

In these conditions—assuming that the bye-pass only is burning, and that the hand E indicates by its position on the dial D the hour of opening of the burner—it will be understood that on the hand engaging with the bottom branch of the star it moves the latter to the extent of one branch, which movement will be sufficient to bring the cock from the closed position to that in which one of the openings in the plug coincides with the conduit C. The gas passing freely into the conduit, reaches the burner and becomes ignited on contact with the flame of the bye-pass, which will then be extinguished.

The hand F indicating by its position the hour of closing the burner will at that exact hour come into contact with the bottom branch of the star, which will be shifted in the same way to the extent of one-eighth of a revolution. Thus it will bring the cock into such position that none of the openings in the plug will coincide with the conduit C, and the burner will be extinguished.

A second lighting of the burner will be effected exactly 24 hours after the first, unless the position of the hand E has been modified in the meantime, by a new contact of the hand in question with the star. The same applies as regards the extinguishing by means of the hand F.

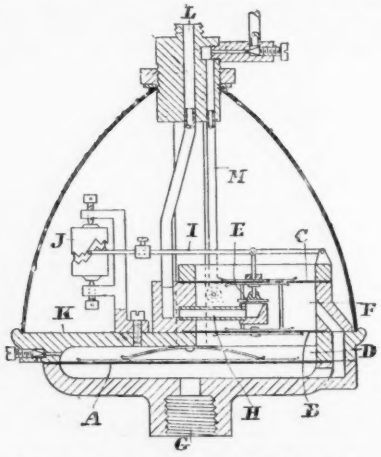
The lighting and extinguishing device can be provided with a casing made of three parts M N O which will not in any way interfere with the working of the cock, but will, on the contrary, prevent any tampering with the device; the regulation of the hands which indicate the opening and closing being possible only to the person having the means for opening the casing.

Lighting and Extinguishing Gas from a Distance.

NASSEN, J. F., and BERGSTRÖM, A. E. T., of Stockholm.

No. 11,371; May 13, 1909. Date claimed under International Convention, May 14, 1908.

In this apparatus two or more diaphragms are provided, one of which acts on the valve or valves for lighting or extinguishing the flames, so that the diaphragms are movable independently of each other and form walls of a closed chamber communicating with the atmosphere through a passage of such small cross-sectional area that the air within the



A Swedish Lamp Lighter and Extinguisher.

chamber has no opportunity to escape, when the one diaphragm moves rapidly, but will transfer its movement on to the other diaphragm, whereas at a slow movement of the former diaphragm the air will escape through the narrow passage, without transferring movement to the other diaphragm.

The apparatus shown is provided with three diaphragms, one of which A is larger than the two others B C, which are of about the same size and firmly connected together by rods, so that one diaphragm always partakes in the movement of the other. Situated between the first two diaphragms is a chamber D communicating through a narrow passage with the outer air. Screwed into the passage is a regulating screw by which the sectional area of the passage may be regulated. Placed in the chamber D is a blade-spring, the free ends of which bear on the upper side of the diaphragm A so that the spring counteracts the gas pressure acting on its lower side. The spring is adjusted for an average gas pressure, and is not provided with any regulating device; "it being of no importance if the diaphragm bellies slightly upward or downward."

The gas-valve E is placed in a chamber F between the diaphragms B and C, communicating through a passage at the side with the chamber below the diaphragm A, and through the latter chamber with the gas-supply conduit G. A pipe H extending into the chamber F carries a seat for the valve disc E attached by a ball-and-socket joint to the diaphragm C, which is further connected to a pivoted lever I. The lever carries a shiftable weight, and is bent at its free end toward the side so as to enter into a groove in the surface of a cylinder rotatably mounted in vertical position in an arm screwed on to the bottom plate K. The pipe H communicates with the passage L leading to the main burner, while the pilot-burner is supplied with gas through a narrower tube M issuing from the chamber F between the diaphragms B and C.

The gas enters through the conduit G into the lower chamber, from which it passes into the chamber F. However, inasmuch as the diaphragms B and C are of about the same size and connected to each other, the pressure cannot produce any movement of the diaphragms, and, on this account, the valve E remains closed. On the other hand, the gas can freely pass through the tube M to the pilot-burner. Slow fluctuations of pressure have no influence on the valve; for even if the diaphragm A rises and sinks, the compression or rarefaction thereby arising in the chamber D is smoothed out through the narrow passage at the left. If, on the other hand, the pressure in the conduit G is rapidly increased, the diaphragm A rises so rapidly that the air has no time to escape through the passage, but the pressure is propagated through the chamber D to the diaphragm B and causes it, as well as the diaphragm C, to rise and thereby open the valve E. On account of the diaphragm B being smaller than A, the former will obviously move a correspondingly greater distance.

It is, however, obvious that the valve E cannot be lifted higher than admitted by the groove in the cylinder J. When the valve rises or sinks, the cylinder turns, whereby the movement of the lever I is determined by the shape of the groove. By giving the groove a suitable form, it will thus be possible to open the valve by a desired number of increases of pressure. The closing of the valve is produced in like manner by a certain number of increases of pressure dependent on the form of the adjacent part of the groove. The apparatus is thus controlled solely by rapid increases of pressure "which are considerably easier to produce than decreases of pressure."

APPLICATIONS FOR LETTERS PATENT.

18,779.—HUGHES, H. K., "Anti-vibrators." Aug. 16.

18,798.—GRAINGER, H. T., "Gas-stoves." Aug. 16.

18,807.—ACKLAND, T., "Self-closing valves." Aug. 16.

18,838.—JONES, A. O., "Treatment of gases from coke-ovens or gas-retorts." Aug. 16.

18,908.—BERLIN ANHALTISCHE-MASCHINENBAU AKT.-GES., "Conveying and discharging incandescent coke and the like." Aug. 17.

18,920.—JONES, A. O., "Treatment of gases from coke-ovens or gas-retorts." Aug. 17.

19,031.—GLOVER, T., "Testing the capacity of diaphragms, bellows, or like measuring appliance of a gas-meter." Aug. 18.

19,112.—ALEXANDER, W., and APPLEBYS, LTD., "Controlling the opening and closing of grabs, discharging of buckets, and the like." Aug. 19.

19,119.—HARVEY, W. H., "Union-jet and other non-atmospheric gas-burners." Aug. 20.

19,152.—SCHÄFFER AND BUDENBERG, LTD., "Pressure-gauges." A communication from Schäffer and Budenberg G. m. b. H., Germany. Aug. 20.

19,169.—SIMON, C. F., "Automatic recording apparatus for measuring gaseous fluids." Aug. 20.

19,174.—NIESER, E., "Atmospheric burners." Aug. 20.

19,173.—VAUGHAN WILLIAMS, A. A., "Device to enable taps or cocks to be disconnected from supply-pipes or apparatus." Aug. 20.

19,184.—GIBSON, T. S. F., and PALMER, W. V., "Coin-freed meters." Aug. 20.

19,190.—WOODALL, H. W., and DUCKHAM, A. M'D., "Charging gas-retorts." Aug. 20.

19,196.—JOHNSTON, A. A., and CLARK, F. W., "Gas manufacture." Aug. 20.

19,206.—INGREY, C., and BARTLETT, J., "Lighting and extinguishing gas." Aug. 20.

19,212.—NEUE KRAMERLICHT G. M. B. H., "Valvular devices for gas-pipes of incandescent burners." Aug. 20.

19,232.—RIDING, H., and BOYLE, T., "Solderless joint for lead pipe." Aug. 21.

19,239.—HENDERSON, J., A., jun., & D., "Taps." Aug. 21.

19,258.—GERDES, A. F., "Self-acting igniting and extinguishing apparatus for gas-lamps." Aug. 21.

19,297.—HOHMANN, C., "Automatic gas-analyzing apparatus." Aug. 21.

19,300.—STREUBEL, A., and WIGANKOW, F., "Mantles." Aug. 21.

19,305.—DUCKHAM, A. M'D., "Discharging and charging gas-retorts or coke-ovens." Aug. 21.

The Directors of the British Gaslight Company, Limited, recommend a dividend at the rate of 10 per cent. per annum, free of income-tax, for the half year ended the 30th of June.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Date of the Murdoch Gasholder.

SIR,—There appears to be an error in the date attributed to the gasholder at the Soho Works which is illustrated in the last issue of the "JOURNAL," inasmuch as gas lighting was not in use in 1798, nor until several years afterwards. It was only in that year that, according to James Watt, jun., the first experiment was made at Soho, when, we are told, Murdoch "constructed a retort of iron with a tube from it, of perhaps about 30 or 40 feet in length, and to the end of it he applied burners of various dimensions and gave light during the night time to one of the buildings of the Soho Foundry." No mention is made of a gasholder, nor was anything further done with the invention until 1801-2, when, in the latter year, "a public display" of it was made at the celebration of the Peace of Amiens. Watt further states that "till 1804 we continued making experiments . . . upon *the size and construction of the gasometers;*" and the first gas-works constructed by Murdoch, which was for Phillips and Lee's factory in Manchester, had a series of *rectangular* gasholders, each of the capacity of about 1000 cubic feet only. This is proved by the original drawings for the works, which are dated 1806, and are reproduced in my "History of the Introduction of Gas Lighting."

There is other evidence in the Murdoch papers to show that the first gasholders used by him were small rectangular vessels; and this form of holder was shown in Accum's "Treatise on Gas Lighting," published as late as 1815. Some years ago, Mr. George Tangye very kindly sent me an illustration of this gasholder at the Soho Works, which appears to me to belong to a much later period than 1798. It would, however, be interesting to know upon what grounds this year has now been fixed upon as the date of its erection.

CHARLES HUNT.

17, *Victoria Street, S.W., Aug.* 26, 1909.

Allowance of Income-Tax for Depreciation of Plant.

SIR,—An important circular has been issued by the Board of Inland Revenue to their surveyors regarding the allowance of income-tax in respect of depreciation of gas and water undertakings. The circular is of a very drastic nature, and provides as follows:—

> No depreciation should be allowed in any circumstances in respect of any portion of these undertakings. Repairs and renewals, excluding extensions and improvements, to be allowed as working expenses as and when incurred. Exceptional expenditure on *bonâ fide* renewals, where the full effect cannot be given in one year, may be carried forward in the following year or years. These instructions to take effect for the year 1908-9, and for years preceding in cases where claims of depreciation are at the present time awaiting settlement.

This circular was sent to me in connection with one of the Gas Companies under my charge, in which I had obtained an allowance of 3 per cent. on the present value of all plant and machinery. I was first granted such an allowance on appeal before the Special Commissioners on behalf of the Ascot District Gas Company, and have obtained the adoption of the same principle in some ten other Gas and Water Companies with which I have dealt.

I think it only right to point out, for the benefit of the gas industry, that the circular referred to emanates only from the Board of Inland Revenue, who are in this matter the opponents of the companies. Many people are apt to look upon the decisions of the Inland Revenue as being final and conclusive, whereas the instructions contained in the circular represent only the views entertained by the officials. It is most important that gas companies should take care that their view of the case is brought before the Commissioners of Taxes—the ultimate judges—before whom each case may be brought to appeal.

For my own part, I have given notice that I cannot accept the instructions of the Board of Inland Revenue to Surveyors as a decision, seeing that the Special Commissioners have decided otherwise; and I am therefore making the question the subject of a further appeal, on the ground that it is going back upon that which has already been settled, at considerable trouble and expense, on appeal before the Special Commissioners, when all the arguments in reference to the general question of depreciation of gas plant were brought up by myself.

I would suggest that all those who have received similar notices should take the matter up without delay, as it is of considerable importance to the whole of the gas world that the principle which has been once adopted should be retained as a basis for assessment in the future.

W. A. SCHULTZ, F.C.A.

50, *Cannon Street, E.C., Aug.* 25, 1909.

Gasification of Coal in Vertical Retorts.

SIR,—In your issue of the 24th inst., there is a welcome communication in Dr. Lessing's letter where he challenges and criticizes the recent experiments of Dr. Julius Bueb, on "The Procedure of Gasification in Vertical Retorts."

The usefulness of such experiments as those of Dr. Bueb is entirely lost in the great and varying conditions between purified coal gas and gas freshly-evolved from the coal undergoing carbonization. Passing notice might be taken of some results of mine that were published in the "JOURNAL," Jan. 12, 1904, p. 80, showing the loss of illuminating power of coal gas by passing it through a tube of red-hot coke, as was similarly done recently by Dr. Bueb.

The question of thermal decomposition being dependent on the rate, or impediment, of flow, as spoken of by Dr. Lessing, calls for something more deserving than can here be dealt with. I would, however, beg for space to add that, in a series of tests I made on coal gas with added enrichment, and passing through a tube of hot coke, I found that the added illuminating power was the first to be lost, and that too very rapidly.

These tests led me to the conclusion that there was an enormous difference in passing purified coal gas through hot coke and what was actually taking place inside a retort, and that the full answer to the question of the destructive influences regulating the decomposition of the gas, whether through coke, rate of flow, or impediment—remained between the point of distillation and the point where the gas reached its fixed state; and that in this margin I saw the worthlessness of all the tests I had made in the laboratory.

I quite agree with Dr. Lessing that the best object-lesson to solve the travel of gases is positive observation and a close study of the coke produced. Dr. Bueb has already said (March 13, 1906): "The gas evolved on carbonization will seek the way of least resistance; and so, passing into the middle of the retort, this core serves as an exit passage."

At Exeter, with whole (dumped-in) charges in the vertical retort, we found there was a hole through the centre of the mass of coke left in the retort, which also pressed tightly on the side of the retort.

From careful observations, I have never found—nor do I still believe—that the passage of gas in vertical retorts is at any time between the retort and the outer crust of coke. The transmission of heat from all points of the circumference towards the centre of a practically cool mass of coal maintains a gentle outward expansion, keeping the first coke made tight against the retort.

The core—cool at first—becomes a swelling, plastic, bubbling mass of coal and tar together, through which the gas evolved from the bottom (poor in quality, it may be, to start off with) of the charge and upwards, must pass through the centre, while some of the tars from the highest portion of the charge necessarily drain downwards.

The penetration of heat becomes more and more rapid, by reason of less area and capacity, until there is nothing left to expand or even fill the void of all that was volatile.

From the hole in the coke with its spider-web-like bridges of tar-coke and the sides spotted with beads of tar-coke, it would appear that the last stage of carbonization is one of sudden contraction.

At Exeter, many engineers saw pieces of coke nearly 3 feet in length, and 1 ft. 6 in. diameter, and a hole through the length of it—as near a circle as possible—about 5 inches in diameter. Many such pieces were produced; and, close study, with careful observation of the charge in the retort, left no doubt as to the travel of gas in vertical retorts being central.

The temperatures of the charges given by Dr. Bueb ("JOURNAL," March 13, 1906) add proof of a centre passage. Dr. Bueb then gave the temperature of the core of the charge as only being raised 250° C. in five hours after the retort had been charged.

T. SETTLE.

Exeter, Aug. 28, 1909.

LEGAL INTELLIGENCE.

GAS COMPANIES' LIABILITIES.

The following is one of the notes in the "Legal Column" in the current number of the "Builder."

A recent decision in the Privy Council raised some interesting points in connection with the liability of gas companies. The defendants were the Dominion Natural Gas Company and the Toronto, Hamilton, and Buffalo Railway Company; the plaintiffs being certain workmen in the employ of the latter Company or their representatives who had suffered injury from a gas explosion. The Gas Company, in consideration of obtaining a wayleave for one of their mains, had contracted to supply the Railway Company with gas at reduced rates, and to furnish meters and regulators. The gas was natural gas, obtained at very high pressure, and it was necessary to reduce this before the gas was used. Part of the apparatus employed to effect this object was a safety-valve. The plaintiffs were suing both Companies. The Railway Company contended that there was no negligence on their part, and that they had discharged their duty by employing competent persons—the Gas Company—to provide the system. The Gas Company alleged, however, that the servants of the Railway Company interfered with the apparatus; and it was proved that they had inserted a tap before the pipe entered the regulator, and had also hammered the safety-valve.

The Courts in Canada had found against the Gas Company; and that Company appealed to the Privy Council. There being no contractual obligation between the plaintiffs and the Gas Company, the Court had to consider what duty the Company owed to the plaintiffs; and it held, on decided cases, that in the supply of articles dangerous in themselves a peculiar duty was imposed on those supplying them, and that in the absence of due precaution it was no defence to say the accident would not have happened but for some other agency, unless the proximate cause was the conscious act of the other agency. In the case in question, the Jury had found that there was negligence because the safety-valve was installed with an emission into the shop instead of into the open air. The true cause of the escape of gas was left in doubt; but it occurred at the safety-valve, not at the tap inserted by the servants of the Railway Company; and the Court held that, initial negligence having been found against the Gas Company, they had failed to prove that the proximate cause of the accident was due to the intervention of the Railway Company's servants and that the Gas Company were liable.

Gas Suffocation Case at Norwich.—Walter Stannard, aged 39, a Norwich upholsterer, was found dead in his house on the morning of last Sunday week, with the gas-burner in the room turned on, but not lighted; and at the subsequent inquest, the jury found that death was due to asphyxia from an escape of gas, but that there was nothing to show how such escape occurred. From the evidence given it appeared that deceased was seen to be the worse for drink on the Saturday morning. The gas-burner was in good order; and on a table beneath it was found a spent match, of a similar kind to others found in the pocket of deceased. No one was in the house with Stannard on the night of the occurrence.

MISCELLANEOUS NEWS.

PROVINCIAL GAS COMPANIES.

Reduction in Price at Bath.

The report presented by the Directors of the Bath Gas Company at the half-yearly meeting last Wednesday was in all respects of a satisfactory character. It set forth that there had been a substantial increase in the consumption of gas, and a decrease in the cost of coal, in the six months ended the 30th of June; and that the favourable condition of the revenue account enabled the Directors to announce a further reduction of 1d. per 1000 cubic feet in the price of gas—bringing it down to 1s. 11d.—from the past Midsummer quarter. The revenue from the sale of gas in the half year was £31,956, against £31,150; but residuals produced only £10,022, compared with £11,919. The total receipts were £46,421, against £47,206. The expenditure, however, was £36 033, compared with £36,286. The balance carried to the net revenue account was £10,388; and the amount available for distribution was £15,320. The Directors recommended the maximum dividend of 5 per cent. per annum on the consolidated stock.

Half-Year's Work at Brighton.

In the report presented by the Directors of the Brighton and Hove Gas Company at the half-yearly general meeting last Friday, they stated that, compared with the results for the corresponding period of last year, the sale of gas in the six months ended the 30th of June had increased by 9,294,200 cubic feet, or 1·52 per cent., but that the sale of residuals had realized £2744 less. The quantity of gas sold to ordinary consumers was 583,491,300 cubic feet; under contracts, 19,202,500 cubic feet; and for public lighting, 17,943,800 cubic feet—making a total of 620,637,600 cubic feet. This produced £91,425; rental of meters, £8992; sale of residuals, £16,877—miscellaneous receipts bringing up the total to £117,451. The expenditure on the manufacture of gas came to £59,345 (raw material costing £41,813); on distribution, £20,593; and on management, £4900—the total expenses being £90,731; leaving £26,720 to be carried to the profit and loss account. Adding the amount received for interest and £12,950 brought forward, a total of £39,689 was produced. After charging interest on the debenture stock, &c., a sum of £37,017 was available for distribution; and the Directors recommended the payment of dividends at the rates of 6 and 4 per cent. per annum on the "B" and "C" preference consolidated stocks, and 11 and 8 per cent. per annum on the original and "A" ordinary consolidated stocks. These payments would amount to £23,653, and leave a balance of £13,364 to be carried forward.

Good Carbonizing Results at Chichester.

A very satisfactory state of things was again reported at the ordinary half-yearly meeting of the Chichester Gas Company on Monday last week. The accounts for the six months ended the 30th of June showed a balance to the credit of the profit and loss account (after providing for the interest on the debenture stock, loans, &c.) of £2249, out of which the Directors recommended the declaration of a dividend for the half year at the rate of 10 per cent. per annum on the "A" stock, and 7 per cent. per annum on the "B" and "C" stocks, all less income-tax. They reported that the business of the Company continued to improve, but expressed regret that the price of coal remained high. The Engineer (Mr. T. E. Pye) reported that the works and mains were in good order. In moving the adoption of the report, the Chairman (Mr. Alfred Lass) said the carbonizing results of the half year had been exceptionally good. The 2753 tons of coal used produced 34,151,000 cubic feet of gas, or a yield of 12,405 cubic feet per ton, together with 12½ cwt. of coke, 10½ gallons of tar, and such a quantity of ammoniacal liquor as would produce on an average sulphate of ammonia equal to 21¾ cwt. per 100 tons of coal carbonized. The quantity of gas sold had been 30,376,000 cubic feet, or 11,034 cubic feet per ton of coal. The increase in the sale of gas on the corresponding period of last year was 1,180,300 cubic feet, or 4·04 per cent.; while the illuminating power and the purity of the gas had been fully maintained. Turning to the revenue account, the shareholders would find that the total receipts from the sale of gas and residual products amounted to £7294, and the total expenses to £5505, which left a gross profit of £1789. The net profit available for dividend was £1486, which, at the various rates recommended, amounted to £1482. Mr. W. A. Walker seconded the motion. Mr. J. Cash (the Engineer of the Brighton and Hove Gas Company), in supporting it, said the Company's position was all the more gratifying in view of the threatened competition from the Electric Light Company. However, they were not at all disheartened by the introduction of electric light into the city, as they could fight it easily. His own experience in Brighton had shown him that they could well hold their own against the electric light; and only a few days previously they had been successful in obtaining a contract for seven years to light the Brighton Railway Station, and a large number of workshops, in face of an extremely low tender on the part of the electricians. It was a strenuous fight, but the Gas Company won it on their merits. He concluded by complimenting the Engineer on his excellent working for the half year. The dividends recommended were then declared; and votes of thanks were accorded to the Engineer, the Secretary (Mr. Victor V. Vick), and the other officers of the Company, as well as to the Directors.

Satisfactory Half Year at Cork.

The ordinary half-yearly general meeting of the Cork Gas Consumers' Company was held last Thursday—Mr. George Lynch in the chair. The Directors reported a decrease in the rental consequent upon a reduction in price at the commencement of the half year, but stated that there had been a slight increase in the consumption of gas. The accounts showed a balance of £5159; and the Directors proposed to pay a dividend at the rate of 8 per cent. per annum. As this would require £5531, it would be necessary to take £372 from the reserve fund. In moving the adoption of the report, the Chairman said the Directors were pleased to be able to record a satisfactory half-year's work. Though they had to take something from the reserve fund to make up the usual dividend, when the causes of the deficiency were considered there was little reason for dissatisfaction. It was chiefly owing to the reduction of 3d. per 1000 cubic feet in the price of gas made at the beginning of the half year. When coals became so much dearer that the Directors had to advance the price, they promised to reduce it again when coals were cheaper. They were so anxious to keep their word to the letter that they were rather premature in making the reduction, having still a considerable quantity of dear coal to work off. Nor did they count on so reduced a return from residuals. Besides being lower in price, there was, from various causes, a deficiency in the quantity sold. At the end of the half year, they had 709 tons of coke on hand, while at the corresponding time last year they had only 57 tons. There had, however, been no falling off in the quantity of gas sold—on the contrary, an augmentation. There was also a steady continuous increase in the various appliances for the use of gas for other purposes than lighting, such as cooking, heating, &c. The number of slot-meters in use was much over 4000; indicating that the working classes were largely availing themselves of the advantages of using gas. Having given particulars in regard to the Company's contracts for the public lighting of different divisions of the city, the Chairman concluded by referring to the visit of the deputation of the Streets Committee of the Corporation of London to various Continental cities, and to the recent success of the Brighton and Hove Gas Company in securing the lighting of the Brighton Railway Station and workshops, as showing that the tide is already turning in favour of gas for street lighting. Mr. Harrington seconded the motion; and it was carried without discussion. The dividend proposed was then declared, and the other business of the meeting disposed of.

Gas Displaces Electricity at Melton Mowbray.

The annual meeting of the Melton Mowbray Gas Company was held last Friday—Mr. J. Glover, J.P., in the chair. In moving the adoption of the accounts, the Chairman said he considered they were very satisfactory; but, owing to extraordinary expenses charged to revenue account, the amount available for dividend was slightly less than last year. The balance, however (£1688), allowed of the payment of the usual dividend of 7½ per cent. on the ordinary share capital. The works had been well maintained, and were in first-class condition; the Directors having during the year added to their purification plant a Livesey washer and a washer-scrubber. One of Braddock's retort-house governors had also been put in; this work being entrusted to Messrs. Robert Dempster and Sons, of Elland. During the past eight years, the streets of Melton had been lighted by electricity; but for the next five years the Gas Company had secured the lighting contract, and the general opinion of the public was that the streets had never been lighted so well as now. The greater part of the work, which included the fixing of eight 1000-candle, six 700-candle, and eight 200-candle Lucas lamps, was entrusted to Messrs. Pontifex and Co., and under the supervision of the Manager of the works (Mr. G. R. Casterton), was expeditiously carried out. The Chairman proposed a vote of thanks to him, and expressed great satisfaction at the general working of the year. The coals carbonized were 3890 tons with a make of 40,726,000 cubic feet of gas—an advance on last year of 2,900,000 cubic feet. Coal contracts had been made at a slight reduction on last year's prices; and with a larger output of gas no doubt was entertained that an even more successful year than the last was before them.

Success of Free Fittings at Royston.

The fifth ordinary general meeting of the Royston (Yorks.) and District Gas Company, Limited, was held at Leeds last Tuesday. Mr. Henry Ellison, the Chairman, presided, and submitted the Directors' report, which stated that, after paying interest on debentures amounting to £225, and the interim dividend on the ordinary shares of £1200, there remained a balance of profit for the year of £2740, which, with £452 brought from last year, made £3192. It was therefore recommended that a dividend at the rate of 12 per cent. per annum for the half year ended June 30 should be paid, which would absorb £1800, and make with the interim dividend for the six months to Dec. 31, 1908, a dividend for the year at the rate of 10 per cent. (free of income-tax). It was also recommended that £750 should be written off for depreciation and preliminary expenses, leaving £642 to carry forward. The Chairman remarked that £4462 had been expended on capital account in an extension of the mains, services, meters, and fittings to Barugh and Smithies. During the year 609 additional meters had been placed, making a total of 4020 now fixed, of which 3548 were prepayment and 472 ordinary. The amount of gas sold was 40,853,300 cubic feet. Having regard to the scattered district supplied, he considered this result justified the policy adopted five years ago of supplying free fittings. The recommendation of the Directors was unanimously adopted. A feature of the meeting was the addition to the Board of Mr. Robert Porter, of Elland. Mr. Porter has acted throughout as Engineer to the Company; and his election as a Director will be regarded as a fitting reward for the successful efforts which he has made on behalf of the undertaking.

A Growing Business at Sutton.

In the report which was submitted at the recent half-yearly meeting, the Directors of the Sutton Gas Company stated that during the past six months the consumption of gas had increased by 7,382,000 cubic feet, or 7½ per cent.; and the revenue from the sales of gas, residuals, and rentals of meters and stoves, showed an increase of £1000 over the corresponding period of last year. In consequence of the increased demand in the southern district, they had been obliged to lay an additional trunk main, which was now nearing completion. The profit and loss account showed a balance of £12,910, from which they recommended the payment, under the sliding-scale, of a dividend at the rate of 5¾ per cent. per annum (less income-tax) for the half year. In moving the adoption of the report and accounts, the Chairman (Mr. Frederick Budgen, J.P.) desired to congratulate the shareholders upon a most successful half year. As a result of their working, they were in a position to recommend the full dividend, according to the sliding-scale, that the present price of gas entitled them to provide—5¾ per cent. per annum. The sales of gas had increased by £1104,

meter-rents by £78, and rental of stoves by £97. Coke was the only item that had produced less revenue. As with other companies, coke had been a drug with them; and £320 less had been received for it. Tar had, however, increased; and £166 more had been received for sulphate. The number of ordinary consumers had increased by 135, slot-meter users by 211, cookers by 124, and gas-fires by 97. So they would readily perceive that their business was a growing one; and it was also, he was glad to say, a remunerative one. It would, perhaps, be interesting to compare the position of the Company and the consumption of gas with twenty years ago. Then 63,700,000 cubic feet of gas was consumed. Ten years afterwards, the amount had risen to 99 millions; and for the year that was now ended, the total was 202 millions. The increase in the consumption of gas was noticeable at the introduction of the slot-meter. The report was adopted; and the dividend recommended was declared.

Progress of the Prepayment System at Waltham Abbey.

At the half-yearly general meeting of the Waltham Abbey and Cheshunt Gas Company last Tuesday, the Chairman (Mr. Alfred Kitt) submitted a report which set forth that the sale of gas had increased by a satisfactory percentage, derived mostly from the progress of the prepayment meter system, and that the whole of the Company's plant (under the supervision of Mr. W. Bince Randall, the Engineer and Secretary) had been maintained in a good and efficient condition. The accounts accompanying the report showed that the revenue from the sale of 36,764,900 cubic feet of gas was £6908, and from residual products £1795—the total receipts being £8706, compared with £8554 for the first half of 1908. The expenditure on the manufacture of gas was £4045; on distribution, £674; and on management, £444—the total expenses being £5901, against £6070. The balance carried to the profit and loss account was £2805, compared with £2484; and the amount available for distribution was £3333. Out of this sum the Directors recommend the payment of dividends at the rate of 8½ per cent. per annum on the "A" shares and 6½ per cent. per annum on the "B," "C," and "D" shares; also the placing of £290 to the credit of the renewal fund. This, with the interest on the debenture stock, would require £2733, and leave £600 to be carried forward. The report was adopted.

Co-Partnership at Watford.

At the half-yearly general meeting of the Watford Gas Company last Thursday, the Directors reported a profit of £3789; and the accounts presented showed a balance of £6513 available for distribution. Dividends at the rates of £7 2s. 6d. per cent. per annum on the "A" stock, and of £5 12s. 6d. per cent. per annum on the "B" stock, were recommended. In moving the adoption of the report, the Chairman (Mr. E. J. Slinn) mentioned that since the meeting held this time last year the Company had sold £3000 of additional stock at the best premium they had ever realized—viz., £533. The number of shareholders had increased by 100 during the past five years; showing that the holding of stock in gas companies was decidedly popular. The expenditure on capital account was chiefly for the new retort-house and coal-store, which were almost finished. Having referred to the principal items in the revenue account, the Chairman stated that the sale of gas was very satisfactory. The reduction they decided to make, as from the 1st of July, would be a concession to the consumers during six months of something like £900. This had not been brought about without due regard to the future. The Directors had made a good contract for coal for the next twelve months, and also for oil for two years. A new departure made by the Directors during the past half year was co-partnership. The Board drafted a scheme, the principal variation from the usual order of things being that the employees contributed to it. This began in July, and the employees were beginning to see the advantage of it in economical working and looking after their own interests. The scheme meant loyal service to the Company. To sum up, it meant time and material saved, mistakes and complaints avoided, and last, but not least, the stockholders would come in for some share of the benefits and get more dividends. The Chairman concluded by giving the proprietors some interesting information in regard to the history of the gas industry. The report was unanimously adopted. The Chairman proposed a vote of thanks to the staff; saying that if the Directors' efforts were not seconded by a good staff, their work could not be so successfully done. The motion having been carried, the Secretary and Manager (Mr. Duncan Royal) returned thanks, and said the staff were very proud to belong to the Company, and to have their efforts recognized in the way they had been.

Striking Increase in Consumption at Weymouth.

The Directors of the Weymouth Consumers' Gas Company reported, at the half-yearly general meeting last Thursday, that the accounts for the six months ended the 30th of June revealed a further extension in the Company's output of gas; the quantity sold during this period being 56,927,700 cubic feet, which was an increase of 3,709,200 cubic feet, or 6·9 per cent., upon the quantity sent out in the first half of 1908. There was, consequently, an increase in the receipts from gas; and the meter and stove rentals showed an advance. These amounts were, however, largely discounted by the diminished returns from residuals owing to the fall in prices. The balance of profit, after paying the fixed charge upon the debenture stock, enabled the Directors to recommend the declaration of a dividend for the half year on the ordinary stock at the maximum rate of 5 per cent. per annum, less income-tax. In moving the adoption of the report, the Chairman (Mr. J. E. Robens) said he thought the shareholders could not do better than congratulate themselves on the success of the past half-year's work. When they considered the great slackness of trade and the depression generally, he thought they must all be very satisfied to think that they had come out with an increase in their gas consumption of 3,709,200 cubic feet, so that their income was now £8539. This was indeed satisfactory, especially considering that they had now to compete with the electric light. When this light was introduced, 68 millions was the extent of their output; and their then Manager (Mr. Lowe) thought it would be a long time before they advanced beyond this figure, because the taking away of the light by the Corporation (and the main portion of the lighting of the borough) and the loss they would necessarily sustain through many of their customers adopting the electric light would be a great check on their undertaking. It was under these circumstances that their present Manager (Mr. D. F. Colson) came to them. They had met with a check for the first year, and during the first half of the year they lost 1½ millions; but in the second half they recovered this, and at the expiration of the year found themselves with 750,000 cubic feet in advance of the preceding year. So that, though they were checked to a considerable extent, they were not thrown backwards beyond the position they had formerly occupied. In that year—five years ago—they had only 250,000 cubic feet increase; but since then the 98 millions had risen to an output of 120 millions; and he thought the shareholders would readily congratulate their Manager on the success which had attended his administration of the affairs of the Company since he had been among them. But the effect of their having increased from 98 to 120 millions had necessitated considerable outlay; and one thing they found necessary was a new holder. This had been put up and already paid for, and was working most satisfactorily. They had also added other things which were necessary; and they were now erecting new purifiers. Referring to the satisfactory relations existing between the consumers, the Corporation, and the Company, he said the consumers looked to them with considerable interest, and placed considerable confidence in them; and the Corporation regarded them as being united with them in receiving the benefits of the Company. The consumers enjoyed with them the advantages of the reduction in the price of gas, and this reduction would necessarily follow after they had put the machinery in proper order. The motion was carried unanimously, and the dividend recommended declared. Votes of thanks were accorded to the Chairman, Directors, Manager, Secretary (Mr. E. Y. Wood), and staff, and duly acknowledged; and the proceedings closed.

Progress at Worthing.

Addressing the shareholders at the half-yearly meeting of the Worthing Gas Company last Saturday week, the Chairman (Mr. H. H. Gardner) said the amount added to capital expenditure during the past six months was £1977, making a total to the end of June of £130,306, to which must be added the nominal capital on consolidation—viz., £38,662, making a total of £168,968. The first item in the capital account expenditure was £1299 for new buildings, plant, &c.; and other expenditure included £635 for additional mains and services and enlargement of old mains. The Directors had instituted a policy of dealing with the old mains that had been laid for some thirty years, by replacing them with new ones out of revenue; but where a larger size main was required, the difference would be charged to capital. New additional meters had been put in at a cost of £234, represented by 66 slots and 50 ordinaries, making a total of 116, which represented the number of consumers added during the half year. The total number of slot meters was now 2943, and of ordinary meters 2859, making a total of 5802 consumers. The coal bill was less by £251; £149 of this being the result of a reduction in the price, and £102 of a reduction in quantity. Notwithstanding the reduction in the price of gas of 2d. per 1000 cubic feet from April 1, which cost the Company £263, the revenue from the sale of gas had gone up by £323; and it must be further remembered in this connection that many great economizers had been brought into use by consumers, which reduced the quantity of gas required. The increase was very satisfactory; and the figures showed excellent working results, reflecting great credit on their Engineer (Mr. W. A. Walker). Repairs and renewals of mains had gone up by £231, which, he thought, established beyond question the prudence of providing £500 towards this outlay in the last half-yearly accounts. There was an increase in the total receipts (compared with the corresponding half of last year) of £373, and a decrease in the expenditure of £195; the net result being an additional profit balance of £568. The balance available for dividend purposes now stood at £16,355, and was £206 higher than the amount brought forward from the previous half year; while they were better off than a year ago by £1478. The motion for the adoption of the report having been seconded, Mr. Schweder said it was claimed that there was a balance available on the profit and loss account of £16,355. Would they tell him where it was, and how they arrived at it? As far as he could see, according to the figures, they owed £24,143, against which they had due to them £12,425. Mr. Alfred Lass then gave an exhaustive statement of an investigation into the affairs of the Company. In the period from 1898 to 1908, the capital employed had, he stated, increased by £50,607, or 5 per cent. per annum compound; and in the same time the gas made had increased by 79,833,000 cubic feet, or at the rate of 5½ per cent. per annum. As the business of the Company had increased at a greater rate per cent. per annum than the additional capital, it was clearly proved that the capital to meet increased business was not called up before it was required. In 1898, the gas sold per ton of coal carbonized was 9898 cubic feet; in 1908, it was 10,489 feet—an increase of 691 feet. These results were remarkably good, and reflected great credit on the Engineer. In 1898, the number of consumers was 2404; and in 1908, 5690—an increase of 3286. In the same period, cooking and heating stoves had increased from 552 to 3973. In 1898, the profits on the year's working totalled £5882; and in 1908, £8092—an increase of £2210. In addition to the dividends regularly paid to the shareholders, the following amounts had been taken out of the profits: Reserve fund, £2808; insurance fund, £2023; renewal fund, £1506—a total of £6337. After paying the dividends for the half year, there would remain, in addition, accumulated profits of £13,432—equal to the payment of more than two years' dividends, assuming the Company did not earn a penny-piece during that period. The Company's assets were quite sufficient to meet the liabilities. If the assets were realized to-day, the Company would be in possession of £24,143, and after paying off the trade liabilities would have in hand £22,692 for division among the shareholders. They might, therefore, assume that the value of the Company's undertaking was somewhat in excess of the capital invested in it. The Company was exceedingly prosperous; and the shareholders ought to congratulate themselves that their investments were so well secured, and that the business was so judiciously and so economically conducted. The report was adopted; and a dividend at the rate of 5 per cent. per annum was declared. Subsequently an extraordinary general meeting was held, at

which the Directors were authorized to raise a sum of £38,980 debenture stock. It was explained that the Board had postponed as long as possible a further issue of capital; and, as a result, the necessary expenditure had occasioned a considerable overdraft on capital account, which must now be provided for.

WINDING-UP OF THE BELPER GAS COMPANY.

Acquisition of the Undertaking by the Derby Gas Company.

A General Meeting of the shareholders of the Belper Gas Company was held at the offices of the Derby Gas Company last Friday for the purpose of having an account laid before them showing the manner in which the winding-up of the Company, on the acquisition of the undertaking by the Derby Gas Company, had been conducted and the property disposed of, for discharging the Liquidators (Mr. Joseph Pym and Mr. J. Ferguson Bell) from their office, and handing over the books and accounts to the Derby Gas Company. The chair was occupied by Mr. JOSEPH PYM.

Mr. H. BULLIVANT (the Secretary of the Derby Gas Company) having read the notice convening the meeting,

Mr. BELL, in response to a request by the Chairman, made the following statement with reference to the winding-up: An agreement was entered into by the Belper Gas and Coke Company on Oct. 30, 1907, to sell their undertaking as a going concern to the Derby Gas Company as from Oct. 21, 1907. Special resolutions were passed for the voluntary winding-up of the Belper Company, and in order to carry out the agreement to sell and wind-up the affairs of the Company Mr. Pym and himself were appointed Liquidators. On Dec. 11, 1907, they entered into an agreement to transfer the undertaking of the Belper Company, to date from Oct. 21, 1907, and the Derby Company agreed to purchase, subject to their obtaining the necessary parliamentary powers to enable them to do so. The Directors of the Derby Company promoted, as agreed, a Bill in Parliament last year, which received the Royal Assent in June, authorizing, among other things, the purchase of the Belper Gas Company upon the following terms: For each share held by a member of the Belper Company, a sum of £20 consolidated ordinary stock in the Derby Company. The capital of the Belper Company consisted of 620 £10 shares fully paid, or £6000, and £2000 5 per cent. debentures. The purchase price agreed upon, as stated in clause 3 of the Derby Gas Act, 1908, in the agreement dated Dec. 11, 1907, between the Liquidators and the Directors of the Derby Company, was £14,600 of consolidated 5 per cent. stock; and the Directors issued to the Liquidators £14,600 of their ordinary consolidated stock. The Liquidators transferred £12,000 of this stock for the 600 £10 shares to the shareholders in the Belper Company, in accordance with their holdings. The balance (£2600 of stock) was sold at an average of £123 per £100, and brought in £3200. From this sum £2000 of debentures were paid off; and of the balance of £1200, £700 was handed to Mr. Pym for the Directors of the Belper Company for compensation for loss of office, and £500 to Mr. Pym for compensation to him for loss of office, as specified in the agreement of Oct. 30, 1907, made between the two Companies. In addition, in consideration of there being a credit balance at the bank, and a surplus after the Derby Company had discharged all liabilities and received outstanding accounts, which were estimated at about £600, the Directors of the Derby Company agreed to pay, in addition to the bonus already named, a bonus of £1 per share. This was paid by the Liquidators out of the assets of the Belper Company, and also later an extra bonus of 8s. per share obtained by the sale of public lamps to the Belper Urban District Council—these lamps not being included in the sale of the Belper undertaking to the Derby Company. The Liquidators arranged with Mr. Bullivant for him to keep the accounts from the commencement until Dec. 31 last, when they were transferred to the Derby Company. Messrs. Timms and Walker had audited the accounts. In addition, the Liquidators paid dividends at the rate of 10 per cent. per annum to the shareholders of the Belper Company. Mr. Bell added that he had before him a detailed statement of the various payments amounting to £16,702 13s. 3d.; and if anyone desired to ask any question concerning them he should be pleased to answer.

No questions being asked,

Mr. FRANK SMITH proposed—"That the accounts submitted to this meeting, showing the manner in which the winding-up of this Company has been conducted and its property disposed of, be and are hereby approved: That the Liquidators be and are hereby discharged from their office; and that the books and accounts of the Company be handed over to the Derby Gaslight and Coke Company." He remarked that it seemed to him that everything had been carried out in a very business-like manner, both to the advantage of the Derby Company and undoubtedly to the advantage of the shareholders of the Belper Company.

Mr. WOOLLEY seconded the motion.

A shareholder wished to move an amendment; but it was ruled out of order, and the motion was carried with one dissentient.

Dawlish Water Supply.—Last week the members of the Dawlish District Council and the officials made their annual inspection of the water-works. Exceptional interest attached to the visit, because the Council have in view a scheme for improving the storage, which will ensure a constant supply of water. At the subsequent luncheon, Mr. J. Shaptor, the Chairman of the Water Committee, said the negotiations with reference to the new scheme was being pushed forward as rapidly as possible. When the scheme was carried out, they would have one of the best and purest supplies of water it was possible to have. Mr. F. S. Cole, the Clerk to the Council, pointed out that the town was in an exceptionally good financial position, as the last instalment of a loan of £10,000 on account of the water-works would fall due in February next. Mr. Churchward, the Surveyor, remarked that in the valley in which their reservoirs were situated they could easily make provision for the storage of sufficient water to supply a town three or four times the size of Dawlish.

EASTBOURNE GAS COMPANY.

Cheap Gas for Hailsham and Polegate—Company's New Act.

The Ordinary General Meeting of the Eastbourne Gas Company was held at the Offices on Monday last week—Dr. G. A. JEFFERY, the Chairman, presiding.

The SECRETARY (Mr. J. S. Garrard) having read the notice convening the meeting, the report of the Directors, together with the accounts for the six months ended the 30th of June, was presented. The latter showed a profit of £7456 on the revenue account; and a sum of £16,861 available for distribution. The Directors recommended that a dividend for the half year should be declared at the rate of 15½ per cent. per annum on the £20,000 of original capital, and also on the £12,500 raised on "C" shares; and at the rate of 12½ per cent. per annum on £94,000 raised on "B" shares. These will absorb £8393; and leave a balance of £8469 to be carried forward.

The CHAIRMAN, in moving the adoption of the report, remarked that the reduction in price from 2s. 8d. to 2s. 6d. per 1000 cubic feet in January last entailed a loss of nearly £1800 to the Company; and they were giving this sum to the consumers and the public authority—giving them the cheapest gas they had ever had. But they were also paying the shareholders 15½ and 12½ per cent.—the largest dividends they had ever received. Therefore, both parties ought to be, if they were not, thankful. Really, the cup of the shareholders was full to overflowing. With regard to the accounts, he was afraid he could not make so satisfactory a statement. The depression in the country had something—in fact, a great deal—to do with it. The sale of gas had increased from 209·4 to 213·11 million cubic feet—or a rise of 3¾ million cubic feet. This was really a falling off from previous returns, owing to the unfavourable season. The number of consumers was 4534 ordinary and 4466 on the prepayment system; making a total of 9000—a gain of 262. This was favourable for a half year. The leakage was still high, and he thought was not satisfactorily accounted for. The net profit was £7456—a decrease of £633. Coals had cost a little less; and they had gained something like £500 through it. Residuals had sold for a little less. Coke especially had had a bad sale; and they were reducing the price of it again. Rates and taxes had been a little lower; and they had gained about £52. Tar and ammonia had sold for a little less. Coke, tar, and ammonia were among the chief products from which they derived their income. They yielded less this year than before, and the reason had been the depression in the country. The weather also had been against the Company. He hoped the shareholders would see, therefore, that the results mentioned in the report had been unavoidable; and next half year he should be able to give them a better analysis. Passing on to refer to the Company's Act, the Chairman said the Directors asked the shareholders' authority to promote a Bill for the acquisition of the undertaking of the Hailsham Gas Company. The Directors met the Directors and the shareholders of that Company on two or three occasions, and soon came to an agreement to purchase. There had been no friction between them; and he believed they would in future promote the Company's interests in every way they possibly could. They were opposed by the East Sussex County Council, by the London, Brighton, and South Coast Railway Company, by the Corporation of Eastbourne, and by the Eastbourne Rural District Council. The opposition of the first three authorities was really a courteous and friendly opposition. But with the Eastbourne Rural District Council there was some difficulty. Their requirements were so exacting and unreasonable, and moreover so unintelligible, that the Directors could not entertain them. They went to Parliament; and the Bill passed safely through both Houses and had received the Royal Assent. All, therefore, was now plain sailing. The Company had a large area, including Eastbourne, Hailsham, Polegate, Hampden Park, Willingdon, Arlington, Hellingly, and parts of Hurstmonceux and Waldron. But they were denied the right of serving part of the area of the Rural District Council, though they had had a petition from the chief residents and a great number of the inhabitants asking for a supply of gas. Well, they were deprived of it, for what reason he did not know. He thought there was a bright future before the Company. He had prophesied this for fifty years; and he still predicted that their future would be as bright as the past had been.

Mr. A. W. OKE, in seconding the motion, warmly congratulated the Directors on the fact that the Bill had passed without any opposition from the Corporation of Eastbourne. This showed, he said, that good relations existed between the Directors and the Town Council. He looked forward to a very large increase in the sale of gas, which would not only provide the full dividends, but a substantial surplus, enabling the Company to avail themselves of the provisions of the new Act. Not only would Eastbourne be supplied with gas at a very low rate, but the country districts—especially Hailsham—would receive gas at prices that perhaps they scarcely dreamed of a short time ago.

The motion having been carried, the dividends were declared.

Thanks were then accorded to the Directors, officers, and workmen, for the care with which they had conducted the affairs of the Company, as shown by the accounts and by the growth and progress made.

The CHAIRMAN having briefly acknowledged the vote,

Mr. H. E. JONES (the Company's Consulting Engineer) also responded. He expressed his pleasure at being associated with so prosperous a Company. This prosperity, he assured the proprietors, arose entirely from boldness in reducing the price of gas. With regard to the general prospects of the Company, the Chairman had alluded to them as being bright; and he (Mr. Jones) could fully confirm this. He could assure the proprietors that at the present moment, without any fantastical new experiments or new ideas, the old-fashioned kind of retorts they had were worked in the special manner which had lately been adopted—maintaining a longer period for charges, and filling better by machinery. They must no longer be contented with producing the quantity of gas per ton of coal they had been making. Not only would they be able to make better coke, but a great deal more of it. The Directors never refused the officers any productive outlay they asked for; and he ventured to prognosticate that the returns would be largely extended in the near future.

The CHAIRMAN, responding to a vote of thanks to himself, referred to

the Company's increased area, and said they took gas to Hampden Park and Willingdon, where there was a full supply. During the last few weeks Polegate had been served, and he was told that the demand was very satisfactory. They had 40 consumers, all of whom were using gas for cooking, and they had 60 applications. They were going on to Hailsham—they were half-way there—and by the end of September or October they would be supplying that market town with good gas at 2s. 11d. per 1000 cubic feet, against the 5s. 3d. now being paid there.

PROVINCIAL WATER COMPANIES.

During the past few weeks, meetings have been held of many Provincial Water Companies; and we give below the points of general interest from reports of some proceedings which have come to hand.

Barnstaple.—Mr. C. E. R. Chanter presided at the last half-yearly meeting of the Barnstaple Water Company, and congratulated the shareholders on the steady progress of the undertaking. The water-rate for the half year was £1929, compared with £1916 for the corresponding period of last year. There was an increase from £75 to £134 in the expenses of repairs and maintenance, owing to the large amount of work done at the old filter-beds. Satisfactory results had followed the alteration of the filtering arrangements. A waste-water meter had been installed, and had led to a large number of repairs to the mains being carried out. The Directors had made their customary yearly inspection of the works, and found them in a thoroughly efficient state. The engines and boilers which were put down in 1889 were in practically as good a condition as they were at that time. An extension of mains had been made to Bishop's Teignton, to meet the wishes of residents. This might not prove immediately profitable; but he had no doubt that the people would be glad to avail themselves of the facilities which the Company were in a position to afford, and that ultimately a very satisfactory income would be derived from this place. The accounts showed that there was a balance of £2174 to the credit of the profit and loss account; and dividends of 10s. each on the original shares and 7s. on the "B" shares were declared.

Chester.—There was a sum of £2255 available for distribution at the 105th half-yearly general meeting of the Chester Water Company; and the Directors recommended the payment of the usual statutory dividends, which would absorb £2077. Reference was made in the report to the death of Mr. Crowe, who had been for 38 years the Company's Engineer; and it was mentioned that the works were under the care of Mr. C. W. Bennett. The Chairman (Mr. F. E. Roberts), in moving the adoption of the report, said that the Company had had a quiet and peaceful half year, and the Directors had little to tell the shareholders. They had one sad event to mention, and that was the death of Mr. Crowe, who had been a tower of strength to the Company for many years, owing to his very able management of the part of the undertaking which came under his supervision. The Directors had made temporary arrangements for the engineering department. Mr. Bennett, who had been a good many years in the service of the Company, was now in charge of the works, subject to the kind supervision of a Consulting Engineer, who would help him in any difficulty, and confer with him as occasion arose. He (the Chairman) would like to express the feeling of regret they all shared that the citizens of Chester were losing the services of Dr. Thomas as Medical Officer of Health. Their experience of him was that he had shown himself most able in the management of his department, and their dealings with him had always been pleasant and without friction. Dr. Thomas had kept a lynx eye on the water-works during the past year; and his verdict was that the "Chester water supply is generally of exceptionally good quality." They were glad to find Dr. Thomas's analyses confirmed those made by the Company's officers and experts for their own guidance. With regard to the dispute with the Guardians, he was glad to tell the shareholders that the Company had lately received between £800 and £900 from them in respect of costs. This was only a part of the large expenditure to which this litigation had unfortunately given rise. They had lately appealed to the Master on a question which affected the main and vital question at issue; and he had decided in the Company's favour. They appealed to a Judge, who did likewise; and now they were going to the Court of Appeal on it. The report was adopted; and dividends were declared at the following rates: 7½ per cent. per annum on the consolidated stock, 6 per cent. per annum on the perpetual 6 per cent. preference shares, and 7 per cent. per annum on the new ordinary stock, 1874.

East Worcestershire.—In the report presented at the half-yearly general meeting of the East Worcestershire Water Company last Thursday, the Directors stated that 83 additional services had been laid on in the six months ended the 30th of June; making the total 7581, exclusive of the districts supplied in bulk. The Directors had carefully considered the question of increasing the yield of water at Burcot, and had decided to sink a shaft near No. 3 borehole, and to be connected therewith at a depth of 100 feet. When this was completed, the borehole, which was 400 feet deep, could be carried farther, possibly into the pebble beds. The revenue account showed a balance of profit amounting to £2430, which, with the carry-forward, made a disposable sum of £3274, which it was proposed to appropriate as follows: To pay a dividend for the half year at the rate of 5 per cent. per annum, free of income-tax, £1831; provide for depreciation on buildings, machinery, and mains, £600; and carry forward the balance, £843. The report was adopted.

Frimley and Farnborough.—At the 32nd half-yearly meeting of the Frimley and Farnborough District Water Company, the Directors reported a balance of £5076 on the revenue account for the half year ended June 30. After paying debenture interest and adding the sum of £7245 brought forward, there was left a disposable balance of £11,820. Out of this the Directors recommended a dividend for the half year at the rate of 7 per cent. per annum, carrying forward £8207. During the six months, 147 additional houses and 14 meter connections had been made, and the service-mains had been extended about 1¼ miles. The new subsiding reservoir at the Frimley pumping-station, with a capacity of 783,000 gallons, was completed; and the embankments for two others were well forward. By their new Act the Company's area would be extended over 17 parishes; and the deep well and pumping-station at Greywell, the high-level service reservoir at North Warnborough, and other works, were authorized. The capital would be increased by £70,000, with the usual borrowing powers. In moving the adoption of the report, the Chairman (Alderman C. Pain, J.P.) reminded the proprietors that some time ago the Company purchased 6 acres of land at Greywell, under the roving powers clause in their Act, and proposed to sink a well on it; but they were stopped by injunction. Hence the necessity for going to Parliament. He was glad to say they were successful in carrying their Bill through the House of Lords, and no opposition was offered in the Commons. The area of the Company's district prior to the Bill passing was 78 square miles; and it would now be increased by 49 square miles, besides the area over which the Company supplied water to the Wey Valley Company—38 square miles—making a total of 165 square miles. The works proposed were the completion of the well at Greywell and the construction of a reservoir at South Warnborough, which would be of the same level as Heathy Park reservoir—viz., 610 feet above Ordnance datum. From these and the other reservoirs, it was hoped to be able to tide over the difficulties that had arisen in the past. Mr. H. J. B. Hollings, in seconding the motion, said the shareholders owed a debt of gratitude to the Chairman for his work in connection with the Company's Bill. Mr. Temple Cooke said he was glad to bear testimony to what had been stated by Mr. Hollings with regard to Mr. Pain's work. Had it not been for the Chairman, he very much doubted whether the Bill would have passed. The motion having been carried unanimously, Mr. E. K. Burstal was elected an Auditor of the Company in succession to Mr. T. B. Forwood, who had become a Director; the Chairman remarking that Mr. Burstal was an experienced water-works engineer, and that the Company were fortunate in obtaining his services. He also thanked his colleagues on the Board and the shareholders for their expressions with reference to his work in connection with the Bill.

Grantham.—The accounts which the Directors of the Grantham Water Company presented at the recent half-yearly general meeting showed a balance on the revenue account for the six months ended June 30 of £12,240. They proposed that £2000 should be applied in payment of a dividend at the rate of £10 per cent. per annum for the past half year, and that the balance of £10,240 should be carried forward. In proposing the adoption of the report, the Chairman (Mr. J. G. Thompson) said there had been a diminution in the revenue of the Company for the half year, compared with the corresponding period of 1908; but this did not take them by surprise when they remembered the amount of rain there had been. Another reason was the state of trade in the town, which had been depressed. But from the meter reports since the half year had turned there had apparently been a decided revival; and he hoped the town would now see prosperity. The Chairman referred to the new sedimentation reservoir which had been erected, with a capacity of 70 million gallons, and said the work had been completed most satisfactorily, and reflected the greatest credit on their Engineer (Mr. H. Preston) and the Consulting Engineer (Mr. W. Matthews). With reference to the Company's new parliamentary powers, he would say, to prevent any misconception on the part of the shareholders, that it was not the intention of the Directors to issue fresh capital, as the money required by the Company would be raised by debentures. Mr. H. M. Escritt seconded the motion; and the report was adopted.

Maidstone.—At the half-yearly meeting of the Maidstone Water Company, the Directors reported that the water-rents in the six months ended the 30th of June amounted to £6828, being an increase of £49 compared with the corresponding period of 1908, and that there was a sum of £8073 to the credit of the profit and loss account. They recommended a dividend (free of income-tax) for the half year at the rate of 7½ per cent. per annum on the 10 per cent. shares, and at the rate of 5¼ per cent. per annum on the 7 per cent. shares; also that £3000 should be transferred to a contingency account, leaving £3339 10 be carried forward. In moving the adoption of the report, the Chairman (Mr. W. H. Bensted) said there had been an increase in the rates for domestic services; but the revenue from the supply by meter was practically the same as in the past half year. They could not hope for any great increase in revenue until the town was in a more prosperous condition; there being a great number of empty houses. The motion was carried. A report was read from Dr. Sims Woodhead, the Company's bacteriological expert, to the effect that he found on the 6th of July that the conditions under which the water was gathered and stored were excellent. He had visited all the gathering-grounds, &c., in company with Dr. Howarth (the County Medical Officer), Dr. C. Pye Oliver (Medical Officer of Health for Maidstone), and the Company's Engineer (Mr. W. Ware).

South Essex.—In moving the adoption of the report of the Directors at the ordinary meeting of the South Essex Water-Works Company, the Chairman (Mr. Courtenay C. S. Fooks) said the Company had had a very successful half year; the profit amounting to £15,510, against £14,747 for the corresponding period of 1908. They had earned almost enough to pay their maximum dividends; but they thought it not advisable to do so at present, because it meant that they would automatically have to reduce at once the price of water to houses of less than £30 annual value. Until they saw their way to continue to pay the maximum dividends, they considered the wiser course was to conserve the Company's finances and proceed a step at a time. Rates and taxes showed an increase of £600 for the six months. So long as there were municipal undertakings in the district, such as electric lighting works and electric tramways, which were not run at a profit, the ratepayers would have to make up any deficit; and as the second largest ratepayers, the Company were rather heavily hit. It seemed to him a wrong state of things that those who had to pay the greater part of the rates should have no voice in the spending of the money. The Board were advised that, with the completion of the Seven Kings' well and the Dagenham well, a sufficient supply of water would be provided for the district in advance of the ordinary growth of the population. The motion was carried. The proposed dividends on the ordinary

stocks 1861, 1882, and 1901, at the rates of £9 15s., £6 16s. 6d., and £4 17s. 6d. per cent. per annum, were agreed to.

South Hants.—The half-yearly ordinary general meeting of shareholders in the South Hants Water Company took place last Friday, at the offices in Southampton, under the chairmanship of Mr. W. E. Darwin, J.P. The report presented showed that since the last meeting the rent roll had been increased by the addition of 308 houses, representing a rental of £626; while the balance on the profit and loss account had been raised to £9393. The remarks of several speakers emphasized the gratifying progress of the undertaking; and it was agreed that the interim dividend should be at the maximum rate on each class of ordinary shares—viz., 10, 7, and 5 per cent.

Wrexham.—The statement of accounts submitted at the annual meeting of the Wrexham and East Denbighshire Water Company showed that the expenditure for capital purposes had been £3574, which, the Directors explained in their report, included payments in respect of the new reservoir at Ty Mawr and for extensions of mains carried out under an agreement with the Hawarden Rural District Council. The storage reservoir at Ty Mawr had been completed, and brought into use. By the construction of this work, which had occupied the attention of the Directors for six years, the Company were enabled to meet the increasing requirements of the district without having recourse to pumping. The necessity for further addition to the filtering capacity of the works had been under consideration, and the construction of a new filter-bed had been undertaken. This would enable the Company to meet future demands and maintain the high quality of the supply. Receipts on revenue account (£11,486) showed an increase of £359 compared with the preceding year, and of £966 compared with 1907. During the year water had been laid on to 226 houses, making a total of 6835 houses now supplied. After payment of the usual charges, the dividend upon the preference stock, the interim dividends at 6½ per cent. per annum upon the consolidated stock and £4 11s. per cent. per annum upon the ordinary stock for the half year ended Dec. 31 last, and interest upon mortgages and debenture stock for the year, a balance remained of £8629. The Directors accordingly recommended the payment for the half year of the preference dividend, and also dividends at the rate of 6½ per cent. per annum upon the consolidated stock, and £4 11s. per cent. per annum on the ordinary stock, all free of income-tax. The Chairman (Mr. J. Alington Hughes), in moving the adoption of the report, pointed out that rates and taxes still headed the expenditure, amounting to £1328 out of a total working charge of £3300, or no less than 40 per cent. Mr. Frederick Storr, the Company's Engineer and Secretary, acknowledging a vote of thanks to the officials, mentioned that the Ty Mawr reservoir contained 134½ million gallons of water, and there was room to make the storage up to 170 millions.

DEFECTIVE LIGHTING OF MANCHESTER SCHOOLS.

It would seem, from a communication published in the "Manchester Guardian," that the lighting of many of the public schools in the city leaves much to be desired. The correspondent says: "A week ago I had to take refuge from the sudden storm in the doorway of one of our city schools. Though it was early in the morning of a summer day, the building was temporarily plunged in darkness, and recourse had to be had to artificial light. Imagine my surprise when I discovered that the lighting equipment for a large class consisted of only two branches, each suspended a good way above the heads of the scholars, and bearing a few ordinary gas-jets, which emitted but a dim light. No wonder the poor children had to stoop uncomfortably over their work." The correspondent alleges that this state of affairs is pretty general in Manchester schools, and he recalls that last winter the officials of the Corporation admitted that the illuminating power of the gas had been reduced; it being expected, however, that this would be more than compensated for by the use of incandescent mantles. He expresses the hope that, as winter is at hand, when a part, at least, of the day's work will have to be done by the aid of gaslight, the authorities will see to it that incandescent mantles are fixed in all the schools.

GERMAN TRADE IN GAS PLANT AND APPARATUS IN 1908.

The annual report of the Berlin Chamber of Commerce for the year 1908 comprises two volumes, in the second of which different branches of industry are reviewed in detail. The "Zeitschrift für Beleuchtungswesen" has recently contained a series of articles giving extracts from this report in so far as it concerns the lighting and heating industries.

It is mentioned that very large imports of gas coke took place from England, and incidentally contributed to the lowering of the price of coke which occurred within the course of the year. There was a large increase in the amount of petroleum imported from Austria, partly accounted for by the fact that there was a great improvement in the quality of the oil from this source. The gas oil imported amounted to more than double the quantity brought into Germany in the previous year, and it came almost exclusively from Austria-Hungary. The greater part of it was destined for carburetting illuminating gas. There was generally an appreciable reduction in the price of petroleum products. The chief raw materials for mantle manufacture remained at practically the same prices as in the previous year, although some of the auxiliary materials were distinctly cheaper. The selling price of the products was, however, depressed; and, owing to the general industrial conditions, the demand was not great.

The industry has benefited by technical improvements; but considerable uneasiness was caused by the project for the taxation of gas and electricity, and in particular by the tax on mantles. There was some improvement in the business done in gas and water fittings; but ultimately prices fell in sympathy with the reduction in the cost of raw materials. It is pointed out, with reference to the construction of gas-works and the manufacture of gas-works plant and apparatus, that this branch of industry has the advantage of a continuous increase year by year in the number of gas-works in the world. Fresh towns constantly decide to introduce gas supply, either by building their own works or obtaining gas from the nearest existing ones. In either case new plant is required. On the whole, business in gas-works plant and apparatus was satisfactory during the past year, and raw materials were obtainable at lower prices than previously. So far as export from Germany was concerned, it is reported that the tariffs in operation in most countries prevented much business being done with them. In particular, importation of gas-works apparatus into Austria was practically brought to a standstill by the prohibitive duty of £1 per 100 kilos. weight. The conditions for export to countries lying beyond the Continent of Europe were more favourable, and a number of large commissions were obtained. The prices, however, were somewhat low. At home activity in the manufacture of gas-works plant and apparatus was towards the end of the year somewhat checked by the promulgation of the scheme for the taxation of gas.

SALE OF GAS COKE IN FRANCE.

Managers of gas-works have always experienced difficulty in selling their coke; and it is not rare to see large accumulations which are a real encumbrance to the works. They have consequently long been endeavouring to find some means to assist the sale of this fuel. Association was clearly what was needed, and combinations of gas-works were formed in different districts in France. Of course, it is the northern and Paris group which is the most important, comprising as it does about 140 works. It is pointed out in the "Echo des Mines" that, notwithstanding this *entente*, the difficulties in the sale of coke have persisted. It was accordingly decided to form a new organization comprising nearly all the gas-works in France, which number about 700. Matters, however, are not yet settled, as some of the works continue independent. The organizers do not pretend to disguise from themselves the difficulties to be overcome. At the present time there is great disorder in the district organizations, and it is quite rare for works to furnish the sales office with the quantities of coke they undertake to supply every fortnight. In fact, it is not a question of selling all the coke produced in the works in the group, but simply what is left after the needs of the works have been supplied. However, an understanding on the matter will be come to very shortly.

Meanwhile, a limited liability company has been formed in Paris, under the title of "L'Office des Cokes," the principal object of which is to extend the use of coke for domestic purposes. It is stated that the Company has been started by the city coal dealers; and it is thought that by replacing the leading gas companies of the Seine, it will render great service to all. The consumers will obtain favourable prices owing to the centralization of orders and to securing the best terms of delivery; the gas-works and their workmen will be benefited by having an assured market for their products; and the collieries will not suffer from a fall in coke, which could not fail to affect the price of coal.

FOREIGN PATENTS IN ENGLAND.

The Patents and Designs Act, 1907, came into force on the 28th of August last year so far as regards section 27, which deals with the revocation of patents worked outside the United Kingdom. At the end of last week, therefore, this portion of the Act had been in operation for exactly twelve months. The Act gives power to any person to apply to the Comptroller-General for the revocation of a patent, after it has been in existence four years, on the ground that the patented article or process is manufactured or carried on exclusively or mainly outside the United Kingdom. According to an article in "The Times" last Thursday, during the year which has elapsed since the above-named section came into force, 69 applications for revocation of foreign patents were made to the Comptroller-General; and in ten cases only were patents revoked by him. In four of them the patentees appealed to the High Court; and in two cases relating to improvements in electric arc lamps, the decision of the Comptroller-General was reversed, evidence having been adduced which was not placed before him, the effect of which was to show that the patented process was being adequately carried on in this country. The two other appeals to the High Court were unsuccessful, so that the number of patents finally revoked was eight. Four applications were dismissed by the Comptroller-General, in addition to the two cases in which his decisions were reversed. No fewer than 28 applications were withdrawn after they had been lodged—in many cases, it is understood, because evidence was forthcoming of "adequate" working. There remain 26 cases which are still officially pending, though in one or two instances the applications have lapsed through effluxion of time.

Our contemporary remarks that it is too early yet to say whether the new power of revocation conferred by the Act of 1907 is likely to have any appreciable effect in reducing the number of foreign patents taken out in this country. In the first seven months of the present year, there were 17,869 such patents applied for—an increase of 1566 compared with the corresponding period of 1908, though only an increase of 319 upon the larger figures for the first seven months of 1907. Sixteen fewer patents were taken out in 1909 by American subjects than in 1908, and 331 fewer than in 1907. The decrease in German patents has been consistent—2000 in 1907, 1822 in 1908, and 1735 in 1909; and the same may be said of Austrian patents—253, 234, and 192 respectively. French patents, which were 620 in 1907 and 670 in 1908, decreased to 560 in 1909.

In Melbourne last Wednesday the verdict was given in a libel action brought by Mr. Swinburne, who was Minister of Water Supply and afterwards Minister of Agriculture in the Victorian Cabinet under Sir Thomas Bent, against the "Melbourne Age," on account of some reflections on his alleged conduct in connection with tenders for water supply. The plaintiff claimed £5000 damages; and he was awarded a sum of £3250.

HALIFAX AND THE WALSHAW DEAN RESERVOIRS.

Reducing the Leakage.

On the invitation of Mr. Mark Crossley, the Chairman of the Halifax Water Committee, the members of the Town Council last Tuesday paid a visit to the Walshaw Dean reservoirs of the Corporation. These reservoirs were formally "opened" nearly two years ago; but up to the present time no water has been taken from them for supplying the town. They consist of three stretches of water; and leakages have been discovered at both the lower and the middle embankments. The Engineers (Messrs. G. H. Hill and Son, of Manchester) are engaged at the present time in endeavouring to stop the crevices through which the water escapes, by grouting with liquid cement through boreholes in the embankments. So far the expenditure on this work has amounted to from £3000 to £4000.

In the course of the inspection, Mr. G. H. Hill explained that at first there was a small leakage of about 10,000 gallons a day at the embankment of the lower reservoir; but suddenly, in one night last April, it increased to 400,000 gallons a day, though the level of the water in the reservoir was just the same as before. Since April, they had been grouting; and the leakage was now 115,000 gallons per day. The water in the reservoir had been kept at 12 feet from top-water level; and when raised a further 2 inches, the leakage had not increased. Therefore he considered that the results of the grouting operations were very satisfactory. They were going to increase the grouting down the shaft at the lower embankment; and he thought they would secure a further reduction, but they would have to put fresh holes in the side of the shaft. Some 50 tons of cement had been put down the shaft; and they had not been able to trace any of this coming out with the leakage on the other side of the embankment. In the lower heading, which was below the shaft he had referred to, there were two fissures; but these had been made good with 12 tons of liquid cement. As soon as they had done all they could at the lower embankment, they would deal in the same way with the leakage near the valve shaft at the middle embankment. In the meantime, he might say that whatever water did escape at the lower reservoir was not lost by the Corporation, as it went towards the 1½ million gallons of compensation water which had to be turned down the stream every day. However, they had to look to the safety of the works, though so far the leakage did not affect their safety—the water was all going through the rocks. The Executors of the Contractor, the late Mr. Enoch Tempest, had received the authority of the Court to make up the subsidence of the embankments; and when this had been done, the water in the reservoirs could without any danger be raised to top-water level. The subsidence in the embankments was only the ordinary settlement, except at the point near the valve-shaft on the middle embankment, where there was a leakage. There need be no fear whatever that the embankment itself was becoming undermined. At the most, the settlement in the embankment was 2 ft. 6 in.; and this was nothing unusual.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The new gas-works at Fauldhouse, to which I more than once made some reference while they were in course of construction, were formally opened on Tuesday afternoon. For the ceremony, a company of about 120 invited guests assembled. They were shown over the works, and had them explained to them by the Engineer—Mr. T. Wilson, of Coatbridge. Thereafter, Mr. James Wood asked Mrs. Prentice, the wife of the Chairman of the Gas Company, to turn on the gas to the town. This having been done amid applause, Mr. Prentice asked the company to adjourn to St. James's Masonic Hall, where refreshments were served. Several toasts were given, including "Success to the Gas Company." In the name of the Contractors and himself, Mr. Wilson presented Mrs. Prentice with a beautiful pearl brooch as a memento of the occasion. The proceedings were wound up by a concert. The works cover an acre of ground, and have a siding running into them from the North British Railway. The retort-house is large and roomy. In the retort-bench there are three ovens, with two, four, and six retorts respectively; and there is space for another oven of eight retorts. Under the same roof is a coal-store, capable of holding 300 tons. There are a vertical condenser, two purifiers 10 feet square, a station-meter, a spiral-guided gasholder, a Foulis underground governor, a suite of offices and workshops, and two weighbridges. The Company start business with over 200 consumers, and 64 public lamps which are fitted with the lighting and extinguishing controller of Messrs. Alder and Mackay, of Edinburgh. The ironwork of the retort-house, the condenser, and the purifiers were supplied by the Barrowfield Iron-Works, Limited, of Glasgow; the gasholder and steel tank, by Messrs. Robert Dempster and Sons, Limited, of Elland; the station-meter, by Messrs. R. Laidlaw and Son (Edinburgh), Limited; the governor, by Messrs. James Milne and Son, Limited, of Edinburgh; the consumers' meters and street lanterns, by Messrs. Alder and Mackay; and the steam-boiler, tar-tank, pump, and weighbridges, by Messrs. Dick-Clelland and Harper, of Glasgow.

I have on more than one occasion commented on the unsympathetic attitude adopted by the officials of the Scottish Office towards the promoters of local legislation. Expression is given to views similar to my own by a Sub-Committee of the Corporation of Greenock, in a draft report to the Town Council regarding the Provisional Order which they recently acquired. The Sub-Committee are of opinion that a great deal of unnecessary trouble and expense was caused by the Scottish Office, whose finical objections seemed eventually to become somewhat tiresome even to the members of the Parliamentary Committee who dealt with the Bill. From time to time, the report states, a Corporation like that of Greenock are in want of capital for new undertakings; and, generally speaking, before authority to borrow can be obtained, the Secretary for Scotland has to give his consent. On several occasions, the Scottish Office complained of the intricate legislation applicable to Greenock; and in the case of a recent loan, it was made

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 559.

Issue	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Apl. 16	10	Alliance & Dublin 10 p.c.	17¾—18¼	..	5 9 7
298,955	10	,,	7	Do. 7 p.c.	12½—13	..	5 7 8
310,000	Stk.	July 14	4	Do. 4 p.c. Deb.	96—98	..	4 0 0
200,000	5	May 27	6½	Bombay, Ltd.	5⅝—5⅞	..	5 10 8
40,000	5	,,	6½	Do. New, £4 paid	4⅛—4¼	+1/16	5 11 0
50,000	10	Aug. 26	15	Bourne- } 10 p.c.	28—28½*	..	5 5 3
311,810	10	,,	7	mouth Gas } B 7 p.c.	16½—16¾*	..	4 3 7
75,000	10	,,	6	and Water } Pref. 6 p.c.	15⅝—15⅞*	..	3 16 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	250—253	..	4 18 10
300,000	,,	,,	9½	Do. New	190—192	..	4 19 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
206,250	,,	June 11	4	Do. 4 p.c. Deb.	100—102	..	3 18 5
220,000	Stk.	Mar. 12	11†	Brighton & Hove Orig.	213—215	..	5 2 4
246,320	,,	,,	8†	Do. A Ord. Stk.	154—156	..	5 2 7
460,000	20	Apl. 16	10	British	43—43½	..	4 11 11
109,000	Stk.	Aug. 26	6	Bromley, A 5 p.c.	117—119*	+1	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c.	88—90*	+1½	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c.	106—108*	+¾	5 1 10
55,000	,,	June 25	3½	Do. 3½ p.c. Deb.	88—90	..	3 17 9
500,000	10	May 13	7	Buenos Ayres (New) Ltd.	13½—14	..	5 0 0
250,000	Stk.	June 25	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
100,000	10	—	—	Cape Town & Dis., Ltd.	4½—5	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	5½—6	..	—
50,000	50	May 3	6	Do. 6 p.c. 1st Mort.	48½—49½	..	6 1 3
100,000	Stk.	June 25	4½	Do. 4½ p.c. Deb. Stk.	82—84	..	5 7 2
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	106½—108½	..	4 12 2
1,493,280	Stk.	Aug. 26	5 3/10	Commercial 4 p.c. Stk.	107—109*	+½	4 15 5
560,000	,,	,,	5	Do. 3½ p.c. do.	103—105*	+½	4 15 3
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	5	Continental Union, Ltd.	95—97	..	5 3 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	138—140	..	5 0 0
491,270	Stk.	—	5	Derby Con. Stk.	121—123	..	4 1 4
55,000	,,	—	4	Do. Deb. Stk.	103—105	..	3 16 2
145,995	,,	Mar. 31	5	East Hull 5 p.c. Ord.	100—102	..	4 18 0
486,090	10	July 14	12	European, Ltd.	24½—25	..	4 16 0
354,060	10	,,	12	Do. £7 10s. paid.	18½—19	..	4 14 9
15,141,545	Stk.	Aug. 12	4⅝	Gas } 4 p.c. Ord.	104—105	..	4 8 10
2,600,000	,,	,,	3½	light } 3½ p.c. max.	87—89	..	3 18 8
3,799,735	,,	,,	4	and } 4 p.c. Con. Pref.	103—105	..	3 16 2
4,193,975	,,	June 11	3	Coke } 3 p.c. Con. Deb.	85½—86½	..	3 9 4
258,740	Stk.	Mar. 12	5†	Hastings & St. L. 3½ p.c.	93—95	..	5 5 3
62,500	,,	,,	6½†	Do. do. 5 p.c.	118—120	..	5 8 4
70,000	10	Apl. 29	11	Hongkong & China, Ltd.	17⅞—18¼	..	6 0 7
131,030	Stk.	Mar. 12	6½	Ilford A and C	141—143	..	4 10 11
65,780	,,	,,	5	Do. B	106—108	..	4 12 7
65,500	,,	June 25	4	Do. 4 p.c. Deb.	102—104	..	3 16 11
4,940,000	Stk.	May 13	8	Imperial Continental	179—181	..	4 8 5
1,235,000	Stk.	Aug. 12	3½	Do. 3½ p.c. Deb. Red.	95—97	..	3 12 11

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
195,242	Stk.	Aug. 26	6	Lea Bridge Ord. 5 p.c.	118—120*	+1	5 0 0
561,000	Stk.	,,	10	Liverpool United A.	223—225*	..	4 8 11
718,100	,,	,,	7	Do. B	164½—166½*	..	4 4 1
306,083	,,	June 25	4	Do. Deb. Stk.	104—106	..	3 15 6
75,000	5	June 11	6	Malta & Mediterranean.	4⅝—5⅛	..	5 17 1
560,000	100	Apl. 1	5	Met. of } 5 p.c. Deb.	101—103	..	4 17 1
250,000	100	,,	4½	Melbourne } 4½ p.c. Deb.	102—104	..	4 6 7
541,920	20	May 27	3½	Monte Video, Ltd.	12½—13	..	5 7 8
1,775,892	Stk.	July 29	4½	Newc'tle & G'tesh'd Con.	106½—107½	..	4 3 9
518,795	Stk.	June 25	3½	Do. 3½ p.c. Deb.	92—93	..	3 12 2
55,940	10	Aug. 26	7	North Middlesex 7 p.c.	133—134*	+½	5 3 8
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	139—141	..	5 13 6
60,000	5	Mar. 31	8	Ottoman, Ltd.	6⅜—6⅝	..	6 5 6
31,800	53	Aug. 26	13	Portsea Island A.	137—139*	..	4 19 0
60,000	50	,,	13	Do. B.	129—131*	..	4 19 3
100,000	50	,,	12	Do. C.	120—123*	..	4 17 7
114,800	50	,,	10	Do. D and E.	101—103*	..	4 17 1
398,490	5	May 13	7	Primitiva Ord.	6¾—7⅛	..	4 18 4
796,580	5	July 29	5	Do. 5 p.c Pref.	5⅛—5⅜	..	4 10 11
488,900	100	June 1	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
1,000,000	10	Apl. 29	8	River Plate Ord.	16⅝—17¼	..	4 12 9
312,650	Stk.	June 25	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
250,000	10	Mar. 31	8	San Paulo, Ltd.	14⅛—14⅝	+⅛	5 8 6
62,500	10	,,	6	Do. 6 p.c. Pref.	12—12½	..	4 16 0
125,020	50	July 1	5	Do. 5 p.c. Deb.	49½—50½	..	4 19 0
135,000	Stk.	Mar. 12	10	Sheffield A	231—233	−5	4 5 10
269,984	,,	,,	10	Do. B	231—233	−2	4 5 10
523,500	,,	,,	10	Do. C	231—233	−1	4 5 10
70,000	10	June 11	10	South African	13½—14	..	7 2 10
6,429,895	Stk.	Aug. 12	5⅓	South Met., 4 p.c. Ord.	119—121	..	4 8 1
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	84½—85½	..	3 10 2
209,820	Stk.	Aug. 26	8	South Shields Con. Stk.	150—152*	+1	5 5 3
605,000	Stk.	Aug. 12	5½	S'th Suburb'n Ord. 5 p.c.	118—120	..	4 11 8
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	122—124	..	4 0 8
502,310	Stk.	May 13	5	Southampton Ord.	110—112	..	4 9 3
120,000	Stk.	Aug. 12	6⅞	Tottenham } A 5 p.c.	130—132	..	5 4 2
453,940	,,	,,	5⅜	and } B 3½ p.c.	109—111	..	4 16 7
149,470	,,	June 25	4	Edmonton } 4 p.c. Deb.	100—102	..	3 18 5
182,380	10	June 11	8	Tuscan, Ltd.	9—9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	99—101	..	4 19 0
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	109—111	..	4 10 1
255,636	Stk.	Aug. 26	6⅝	Wands- } B 3½ p.c.	138—140*	+1½	4 14 8
79,416	,,	June 25	3	worth } 3 p.c. Deb. Stk.	73—75	..	4 0 0
895,872	,,	Aug. 12	5⅜	West Ham 5 p.c. Ord.	124—126	..	4 5 4
210,000	,,	,,	5	Do. 5 p.c. Pref.	127—129	..	3 17 6
253,300	,,	June 25	4	Do. 4 p.c. Deb Stk.	112—114	..	3 13 2

Prices marked * are "Ex div." † Next dividend will be at this rate.

an express condition that Greenock should consolidate its local statutes. A Provisional Order was prepared for this purpose, and was in the hands of the Scottish Office for eighteen months before it came up for consideration by the Parliamentary Committee. Yet it was only a fortnight before the Bill had to be dealt with in London that the Scottish Office lodged a long report, the substance of which was that where there was general legislation similar to local legislation the former should be adopted. The difference between incorporation and adoption, the Sub-Committee state, will probably seem to most people sufficiently slight; and yet it was a subject to which the Scottish Office, as it eventually turned out, was disposed to attach considerable importance. In the case of officials, the time and expense which such discussion caused a corporation appeared not to be taken into account; and the result was an amount of delay which was certainly not contemplated by the town's Parliamentary Counsel and Agent, who were responsible for the drafting of the Bill.

In the report of the Sub-Committee, there is some reference to the expense which has been entailed upon the promoters by objecting petitioners. This has brought the Town Council of the neighbouring burgh of Port-Glasgow into the field, with a series of explanations as to their reasons for opposing the Greenock measure. They explain that the controversy between them and Greenock arose through (1) an attempt by the Greenock Corporation to invade Port-Glasgow's territory and supply electricity, water, and gas without any leave; (2) an attempt to deprive the Council of their rights in connection with the supply of electricity to the Tramway Company; and (3) Greenock's action in adding and having passed by the House of Commons Committee, without any notice, a proviso defeating absolutely the right of the Port-Glasgow Town Council, after having reinstated that right by inserting an agreed-on clause. The Port-Glasgow Town Council, it is pointed out, aimed at nothing more than the maintenance of the *status quo*; and though the Greenock Corporation knew this, from the date of the publication of their Order about sixteen months ago, they compelled the Port-Glasgow Town Council to incur the cost of an opposition to attain their object.

Harrow and Stanmore Gas Company.—At the half-yearly meeting of this Company next Monday, the Directors will report the continued prosperity of the undertaking; there having been a considerable increase in the sale of gas in the six months ended the 30th of June, though the value of residuals had been much depressed. The accounts accompanying the report show a sum of £9627 available for distribution; and the Directors recommend dividends at the rate of £10 10s. per cent. per annum on the "A" capital, £7 7s. per cent. on the additional "C" capital, and £7 per cent. per annum on the additional "B" capital and guaranteed shares, all less income-tax; also that £317 5s. should be placed to the reserve fund, being surplus profits under the sliding-scale not declared in the dividends. This will leave £4314 to be carried forward.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Aug.* 28.

The improvement in the tone of the market remarked upon a week ago has been sustained, and at several points a further advance in prices has been scored. Demand has, however, been primarily for the purpose of completing contracts for August shipment; but August prices have also been paid for September delivery. The closing quotations are £11 2s. 6d. to £11 3s. 9d. per ton f.o.b. Hull, £11 3s. 9d. to £11 5s. per ton f.o.b. Liverpool, and £11 6s. 3d. to £11 7s. 6d. per ton f.o.b. Leith. For delivery up to the end of the year, the ideas of buyers are not over £11 7s. 6d. per ton f.o.b., and there is no great eagerness to purchase in this position. For January-June, January-August, and over the whole of 1910, £11 10s. per ton f.o.b. Leith has been paid; but no higher price has been reported.

Nitrate of Soda.

This market continues without change at 9s. 6d. per cwt. for ordinary quality, and 9s. 9d. for refined.

Tar Products. LONDON, *Aug.* 30.

The markets have been steady during the past week; but there has not been a large amount of business doing, and it is doubtful whether there will be any great revival for some weeks to come. Pitch is very firm indeed. Manufacturers report that they are receiving offers at advanced prices; but in the majority of cases they are declining these, owing to the fact that they have little or none to dispose of. Creosote is very quiet, and prices show a tendency to become still easier. Benzol is steady, though there is not very much business doing; the majority of buyers wishing to purchase for delivery over a long period ahead, to which makers will not consent. Toluol is firm, and in good demand. Solvent naphtha is steady in London, but is quiet in the North. There is little demand for heavy naphtha. Carbolic acid is exceedingly quiet, and sales are reported at very low prices for both prompt and forward delivery. Refined naphthalene is quiet; but salts are in fair demand.

The average values during the week were: Tar, 15s. 9d. to 19s. 9d., *ex* works. Pitch, London, 29s. 6d. to 30s.; east coast, 29s. 3d. to 29s. 6d.; west coast, 28s. 6d. to 29s. 6d. f.a.s. Mersey ports, 28s. to 28s. 6d. f.o.b. other ports. Benzol, 90 per cent., casks included, London, 6½d.; North, 5⅞d.; 50-90 per cent., casks included, London, 7d. to 7¼d.; North, 6¼d. to 6½d. Toluol, casks included, London, 8⅜d. to 9d.; North, 8¼d. to 8⅜d. Crude naphtha, in bulk, London, 3¼d. to 3½d.; North, 3d. to 3⅛d.; solvent naphtha, casks included, London, 10⅜d. to 11¼d.; North, 9⅜d. to 10d.; heavy naphtha, casks included, London, 10¼d. to 10⅜d.; North, 9¼d. to 9⅜d. Creosote, in bulk, London, 2⅜d.; North, 2¼d. to 2⅝d. Heavy oils, in bulk, 2⅝d. Carbolic acid, 60 per cent., casks included, east coast, 10½d. to 10⅝d.; west coast, 10¼d. to 10½d. Naphthalene, £4 10s. to £8 10s.; salts, 35s. to 40s.,

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Sulphate of Ammonia.

The market for this article has been steady throughout the past week, and prices show a tendency to harden all round. The Gas Companies maintain their quotation of £11 7s. 6d.; but at this figure they are still unable to do business, though there are signs that before very long they will be able to pass contracts at this price. The outside makes upon Beckton terms are selling for prompt delivery at £11 1s. 3d. to £11 2s. 6d. Business is reported in Hull at £11 2s. 6d. for prompt for a good make, and in Liverpool at £11 3s. 9d.; while in Leith, £11 6s. 3d. to £11 7s. 6d. is asked.

COAL TRADE REPORTS.

Northern Coal Trade.

There has been a continuance of the fall in the price of steam coals, until some qualities are about 4s. 6d. per ton lower than they were at the end of last month—a very sharp fall. Best Northumbrian steams are now quoted from about 10s. 6d. to 10s. 9d. per ton f.o.b., with a moderate demand. Second-class steams are about 10s., and steam smalls are from 5s. to 6s. The collieries are not working very fully; there being only a moderate export at present. In the gas coal trade, the demand is relatively brisk, with steady prices. Durham gas coals are quoted, according to quality, from about 10s. to 11s. 4½d. per ton f.o.b. for the usual classes, and up to 11s. 9d. for "Wear specials." Sales continue to be made of coal for shipment over a few months ahead to some of the ports of the Mediterranean; and for these good prices seem to be realized. About 10s. 3d. per ton for second-class gas coal appears to be the medium price in these sales; and for best Durham gas coal, from 17s. per ton, at Genoa, is believed to have been paid, for some 60,000 tons, over twelve months. At the same time, some producers do not seem to wish to sell far ahead until the hours question is more settled in the county of Durham. Coke is steady; and the output of gas coke is increasing. The price, however, appears to be steadily maintained at 12s. 9d to 13s. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

The coal market remains unchanged, except that in the case of ell, which is very plentiful, the price is easier. Splint is in fair demand. There is a disposition on the part of buyers to contract forward, the state of the market being considered favourable for this form of dealing. The prices now quoted are: Ell 9s. 3d. to 10s. 6d., splint 10s. 3d. to 10s. 6d., and steam 9s. 3d. to 9s. 6d. per ton f.o.b. Glasgow. The shipments for the week amounted to 342,397 tons—an increase of 23,303 tons upon the previous week, and of 17,528 tons upon the corresponding week of last year. For the year to date, the total shipments have been 9,464,803 tons—an increase of 528,777 tons upon the corresponding period.

Electric Street Lighting at Maidstone.

When moving the adoption of the Electricity Committee's report at the monthly meeting of the Maidstone Urban District Council, Alderman Vaughan remarked that, at the recent meeting of the Maidstone Gas Company, the Chairman (Mr. George Marsham) rather accused the ratepayers of being asleep—for he told them to wake up, which he supposed meant the same thing. It was not fair, however, to state that the town was spending £1000 more a year on the lighting, unless the extra benefit derived was also pointed out. When this matter was brought forward on a previous occasion, the Electrical Engineer showed the additional candle power obtained now compared with years ago; and so convincing was his statement, that all argument against it was closed for the time being. It was not wise to be constantly talking about gas *versus* electricity in Maidstone; but after Mr. Marsham's statement, he had no other alternative than to prove that the Council's case was a good one. In its electricity, the town had a capital undertaking; and he believed they would do better in the future than in the past. Dealing with the same subject, the "South Eastern Gazette" says: "The Corporation do not admit that electric lighting is more expensive than gas lighting; but it is an indisputable fact that the cost of public lighting is now £1000 more than it was before electricity was introduced. It is contended by the Electric Lighting Committee that the town has value for its money in improved lighting; but that, to say the least, is a debatable point. The general evidence that gas is preferable to electricity for street lighting becomes stronger rather than weaker as time goes on; and where the two illuminants are offered by private companies, public authorities as a rule do not now hesitate to choose gas. The policy which is being followed at Maidstone, with its municipally controlled electricity supply, may be defensible; but no conclusive evidence has yet been forthcoming to prove that it is economically sound."

Artesian Wells in the City of London.—As the result of the increased rates levied by the Metropolitan Water Board under their Charges Act, several additional artesian wells are being sunk within the area of the City of London. Referring to the matter, the "City Press" remarks that the principal point connected with the supply obtained from these sources naturally concerns the purity of the water. It is highly important, in the interests of the public health, that the water should be satisfactory in every way, and free from pollution. In this respect, the officers of the Corporation charged with the duty have been, and are, vigilant in exercising a strict scrutiny; and in every instance the supply, on being analyzed, has proved to be of good quality, and above suspicion of any kind. The Medical Officer of Health for the City states that the water to be found under the civic area is both abundant and excellent. From some of the wells the water is pumped at the rate of 6000, 7000, and 8000 gallons per hour; and, generally speaking, it is obtained at depths ranging from 400 to 550 feet.

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Kippax and District Gas Company, Limited.—The second annual meeting of this Company was held at Elland last Tuesday week; Mr. Robert Porter, the Chairman, presiding. In submitting the statement of accounts for the year ended June 30, Mr. Porter pointed out that 95 per cent. of the householders were now consuming gas; the number coupled up being 795. The year's income was £1765, and the net profit £798. It was resolved to pay a dividend of 5 per cent. per annum upon all shares from the date of payment of each instalment. A cordial vote of thanks was accorded the Chairman and Directors for their services.

Accidental Poisoning by Coal Gas.—Miss Makinson, a schoolmistress of Tebay, while spending part of her holidays with her father in Bolton, met with her death under distressing circumstances last week. She was found by her father in an unconscious condition by a gas-griller in the back kitchen. A medical man was summoned, and he tried artificial respiration without avail. There was a bruise on the young lady's head, as though she had fallen over the griller. The stove was not lighted, but the gas was turned on. At the inquest, the doctor who had been called in said death was due to gas poisoning; and he expressed the opinion that Miss Makinson had fainted, and fallen over the stove after turning on the gas. The Jury found that death was due to poisoning by gas fumes accidentally inhaled.

Barnet District Gas and Water Company.—In the report which will be presented at the half-yearly meeting to-day, the Directors state that the mains necessary to give a constant supply of water to the high-level parts of Finchley have been laid and brought into use. Under the Company's Act of 1904, the Directors lately acquired land at Colney Heath, within the Company's water limits, and entered into a contract for the construction of a well so as to provide an additional source of supply to cope with the increasing demands of their district. Shortly after the work had been commenced, an action to restrain the Company from completing their well was brought in the name of the Attorney-General at the instance of the Marquis of Salisbury, who is the owner of a well from which Hatfield is supplied with water. This well is at a considerable distance from the site of the Company's intended well. The action came on for hearing last month, when the Company were represented by Sir Robert Finlay, K.C., and Mr. Balfour Browne, K.C.; but Mr. Justice Ridley, who presided at the trial, having regard to recent decisions under which other water companies have been restrained from carrying out their works, decided against the Company, and granted the injunction asked for. The terms of the Company's Act of 1904 differ from those of the other companies referred to; and, acting on the advice of Counsel, notice of appeal has been given. The hearing of the appeal, it is expected, will take place in the ensuing autumn. The balance standing to the credit of the profit and loss account amounts to £27,577, out of which the Directors recommend the declaration of a dividend, less income-tax, for the half-year ended June 30, at the rate of 7½ per cent. per annum on the "A" and "C" stocks; 6½ per cent. per annum on the "B" stock; and 5½ per cent. per annum on the "D" capital gas and water stocks.

Coal Tar for Roofs.—A correspondent writes to the "Ironmonger" as follows: "I shall be pleased to know what has been the experience of any of your readers in respect of coal tar as a coating on roofing. Seven years ago I put up some buildings, using 22-gauge galvanized iron, and coating the surface with coal tar. I now find the metal badly damaged in places with red rust. I am anxious to do something to prevent it getting into a worse condition, if that is possible."

Manchester Corporation Employees Thrift Fund.—The Manchester Corporation old-age pension and sick benefit fund, which was established in 1893, has now a total contribution of £273,500. On last year their was a gain of £35,719. Each member pays 9d. in the pound; and the Corporation add another 3d., and pay 4 per cent. compound interest on the yearly savings. The capital, with interest, is paid out in a lump sum on a member reaching 65 years of age. There is also provision for members receiving an advance in case of sickness.

Suicide by Gas.—On returning home from his work last Wednesday, a man named Bernard Nash, of Bigland Street, Salford, failed to gain admittance by the front door. He went round to the back, climbed the yard wall, and got in. On entering the house, he found his wife lying on the floor unconscious, with one end of an india-rubber pipe in her mouth and the other end on the gas-bracket, the tap of which was turned full on. He immediately raised an alarm. The police were informed, and a doctor was sent for. Artificial respiration was tried for two hours, but without success.

Reductions in Price.—As announced elsewhere, the Bath Gas Company have reduced the price of gas to 1s. 11d. per 1000 cubic feet. As from the 30th of June, the price of gas supplied through ordinary meters by the Wrexham Gas Company has been reduced 3d. per 1000 cubic feet. The prices are now 2s. 6d. for lighting, heating, or cooking, with a discount of 3d. if paid within a month after the quarter end; and 2s. 2d. for motive power, with a discount of 2d. The Port Glasgow Town Council have reduced the price of gas to ordinary consumers by 2d. and to prepayment meter consumers by 1d. per 1000 cubic feet. The present price to ordinary consumers is 3s. 4d.

New Joint-Stock Companies.—The Etna Lighting and Heating Company, Limited, has been registered with a capital of £1000, in £1 shares, to adopt agreements with J. Warry and G. N. Arculus and with H. R. Prosser for the acquisition of certain patents, rights, tools, &c., and to carry on the business of electrical and gas fittings manufacturers, lighting and heating engineers and contractors, &c. The Patent Wood Pipe and Tube Company, Limited, has been registered with a capital of £5000, in £1 shares, to adopt an agreement with H. P. Hansen, J. Hutchinson, and T. Dodds (trading as the Hansen Syndicate) for the acquisition of a certain invention relating to the manufacture of pipes from wood shavings, and to carry on the business of makers of patent wood pipes and tubes, &c. The Thornaby-on-Tees Gas and Chemical Plant Company, Limited, was registered on the 21st inst., with a capital of £1000 in £1 shares. The first Directors are G. Pettigrew and E. S. Pettigrew.

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Death from Producer-Gas Poisoning.—An inquest has been held at Bishop Auckland on the body of a labourer named Benjamin Hemsley, 64 years of age, who met his death while acting as attendant at the producer-gas plant connected with a forge at the works of Messrs. Robert Wilson and Sons. An engineman stated that he found the deceased gassed, and that witness and another man were glad to get out into the open air as the gas was so strong. The foreman blacksmith gave it as his opinion that Hemsley had found a leak, and was attempting to repair the defect without having previously stopped the working of the plant. Medical evidence was to the effect that death was due to producer-gas poisoning; and the Jury returned a verdict accordingly.

Belfast Corporation and the Sale of Gas-Fittings.—A deputation representative of the various branches of the gas-fitting trade in Belfast have attended before the Gas Committee for the purpose of explaining their ideas relative to the sale of such fittings by the Corporation direct to the public. On behalf of the deputation, Mr. Patterson said he knew that the Committee, at the time they undertook to sell gas-stoves, did so to increase the consumption of gas; and he now understood they were about to make a new departure by selling gas-fittings. Those engaged in the trade in Belfast were prepared, anxious, and willing at all times to sell the best gas-fittings. Owing to the very keen competition, the public were well served; and the Committee would not add one consumer to the numbers they already had by the sale of these fittings. Other speakers asked the Committee to reconsider the matter, and to recommend the Council to rescind the resolution which had been adopted authorizing the Committee to sell fittings. The Chairman (Mr. J. A. Doran) stated that he and every member of the Committee sympathized with the views of the deputation; but numerous complaints had been made by the public about gas-fittings. The only desire the Committee had was that the gas consumers should be supplied with good and proper fittings. The opinions expressed by the deputation would receive careful consideration.

The half-yearly conference of the representatives of the Richmond Gas Stove and Meter Company, Limited, was held at the Company's meter branch (Messrs. George Glover and Co., Limited) on Friday, the 20th inst.—Mr. H. M. Thornton presiding. They afterwards visited the Imperial International Exhibition, where they were entertained at dinner by the Company.

We learn that there has been erected at the Hitchin Gas-Works one of the "Standard" centrifugal washers of Messrs. Kirkham, Hulett, and Chandler, Limited, in accordance with the arrangement described in our "Register of Patents" columns for Aug. 10 (p. 388). It is expected that a trial of the apparatus will be made as soon as the washer has been connected up to the plant by the Gas Company.

A fine of 10s., including costs, was inflicted upon Thomas Feeney, who was summoned for wilfully breaking a street-lamp at Warrington. Defendant was seen to pick up a large stone and smash the glass of the lamp. It was stated by a Corporation official that the damage to street-lamps in Warrington was very great; the cost to the town being £150 annually for the renewal of breakages. The lamp in question had been broken five times during a period of six weeks.

We have received the season's catalogue (1909-10) of the New Inverted Incandescent Gas-Lamp Company, Limited. In its 64 large quarto pages will be found a great variety of burners, fittings, arc lamps, &c., including the "Medium" burner, which comes, in point of size, between the bijou and the large burner. Special attention is directed to this, the latest, pattern as being specially suited for domestic lighting; lending itself admirably to decorative effect, and at the same time attaining a very high efficiency. The catalogue contains some unique designs in fittings and glassware. All the Company's burners have been substantially reduced in price, and with them regulators are now supplied without extra charge.

In "Electricity Supply Memoranda" in the last number of the "JOURNAL," reference was made to some terrible panics caused round about Portsmouth through the fusing of electric wires in places of public resort. The Watch Committee of the Corporation are evidently impressed with the necessity of having gas as a stand-by in the event of a failure of the electric light; for at a meeting held last Tuesday to hear applications from local managers for licences for the performance of stage plays, the Chairman announced that the licences of the Theatre Royal, the King's Theatre, and the Prince's Theatre would be granted, subject to alterations in respect to the provision of gaslights in certain passages. The licence for the South Parade Pier was also granted on condition that gaslights should be installed.

"A Century-and-a-Half of Commercial Enterprise" is the title of an interesting booklet issued by the Carron Company in connection with their 150th anniversary. Founded in 1759, the Company was practically the pioneer of the iron industry in Scotland; and it has played an important part in the history of commercial enterprise. The unbroken business career of the Company is traced, and references are made to the numerous distinguished personages (including His Majesty the King, when Prince of Wales) who have visited the works, the development of which is well illustrated. The foundry work, as our readers may remember, embraces cooking apparatus for coal, gas, steam, and electricity. The account closes with a few remarks on the Company's shipping business, which was in operation long before steam-propelled vessels were invented. The booklet is neatly printed and has an artistic wrapper.

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COUNTY OF LONDON.
THE London County Council invite APPLICATIONS for the Post of VISITING TEACHER of ADVANCED GAS SUPPLY at the L.C.C. Westminster Technical Institute, Vincent Square, S.W., for One Evening a Week. Fee, 21s. an attendance of about Three Hours.
Applications should be made on Form T. 17, to be obtained from the Education Officer, London County Council Education Offices, Victoria Embankment, W.C., to whom they must be returned not later than Eleven a.m. on the 11th of September, 1909, accompanied by *copies* of Three Testimonials of recent date.
All communications on the subject must be endorsed "T. 1.," and a stamped addressed foolscap envelope must be enclosed.
Canvassing, either directly or indirectly, will be held to be a disqualification for employment.
G. L. GOMME,
Clerk of the London County Council.
L.C.C. Education Offices,
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BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the Supply of TUBES and FITTINGS, SULPHURIC ACID, and TINNED GOODS.
Specification and Form of Tender may be obtained upon Application to Mr. W. Whatmough, Gas Manager.
Sealed and endorsed Tenders to be sent to me not later than Tuesday, Sept. 14, 1909.
By order,
GEO. G. BOUCHIER,
Town Clerk.
Municipal Buildings, Heywood,
Aug. 18, 1909.

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THE Directors invite Tenders for the Supply and Erection of a set of Six Cast-Iron PURIFIERS, 40 ft. by 30 ft. by 6 ft., together with Valves, Connections, Oxide Elevators, &c.
Copies of the Specification and Drawings can be obtained on and after Wednesday, the 1st day of September next, on Payment of One Guinea.
Tenders, addressed to the undersigned, to be delivered on or before Wednesday, the 22nd day of September next.
The Directors do not bind themselves to accept the lowest or any Tender.
R. O. PATERSON,
Engineer and Manager.
Gas-Works, Cheltenham,
Aug. 25, 1909.

RAMSGATE CORPORATION.
(GAS AND WATER DEPARTMENT.)

THE Committee invite Tenders for the Purchase of the whole of their Surplus COKE (estimated at from 1500 to 2500 Tons), or for Quantities of not less than 200 Tons per Annum, from the 1st of October, 1909, to the 30th of September, 1910, delivered free on Rail or Barge, Ramsgate, or free into Carts at the Gas-Works, Ramsgate. Purchaser in any case to pay dues.
Further Particulars, together with Conditions and Form of Tender, may be obtained from the undersigned.
Tenders to be sent in not later than Noon on Monday, Sept. 13, 1909, addressed to the Chairman of the Gas and Water Committee, Boundary Road, Ramsgate, endorsed "Tender for Coke."
The Committee do not bind themselves to accept the highest or any Tender.
WM. THOMSON,
Engineer and Manager.
Gas and Water Offices,
Boundary Road, Ramsgate,
August, 1909.

OTTOMAN GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at 9, Queen Street Place, Cannon Street, E.C., on Tuesday, Sept. 7, 1909, at One o'clock precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ended the 30th of June last; to declare a Dividend; and for General Purposes.
The TRANSFER BOOKS WILL BE CLOSED from Aug. 31 to Sept. 7, both days inclusive.
By order of the Board,
THOMAS GUYATT,
Secretary.
9, Queen Street Place,
Cannon Street, London, E.C.,
Aug. 24, 1909.

SUPPLIER of Gas Controller Patent No. 20,109/07, working through pressure, should apply in first instance to "C.C.100," care of NEYROUD & SONS, Advertising Offices, 14-18, Queen Victoria Street, LONDON, E.C.

THE Proprietor of the Patent No. 11,145 of 1901, for "IMPROVEMENTS IN GAS-RETORT CHARGING APPARATUS" is desirous of entering into Arrangements by way of LICENSE and otherwise, on Reasonable Terms, for the purpose of EXPLOITING the same and ensuring its Full Development and Practical Working in this Country.
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MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
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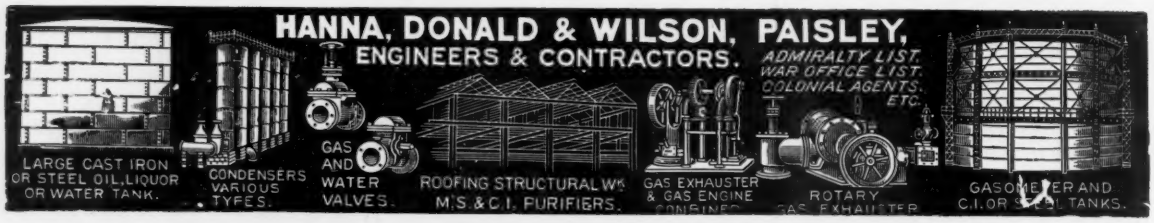

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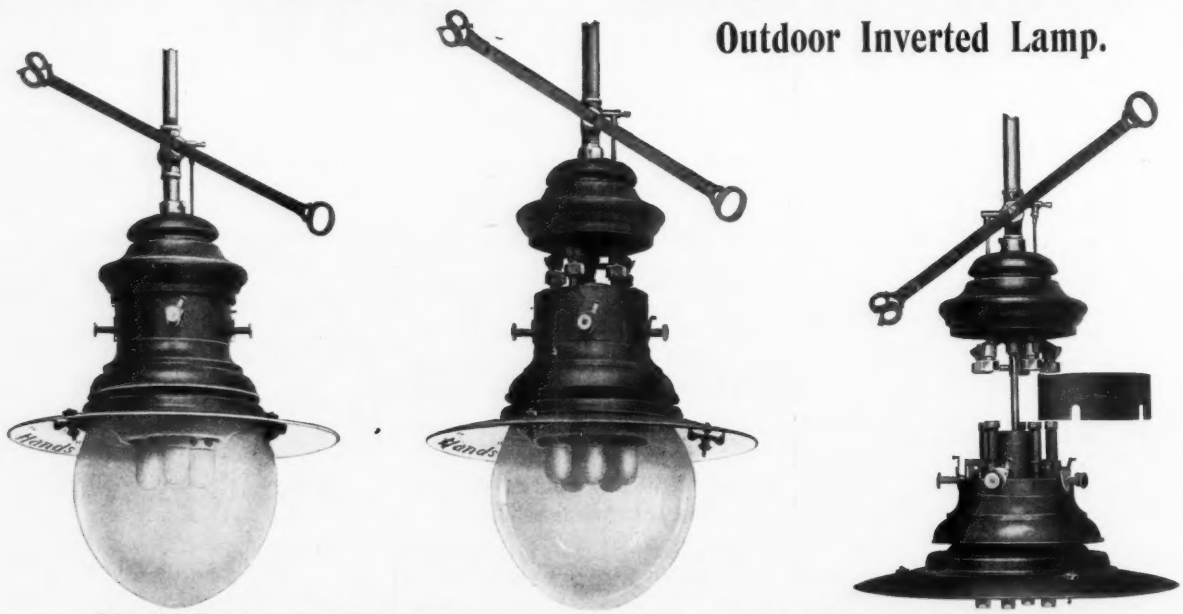

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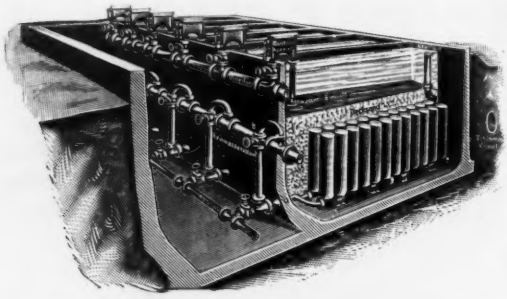

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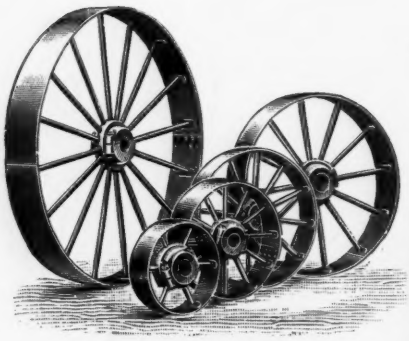

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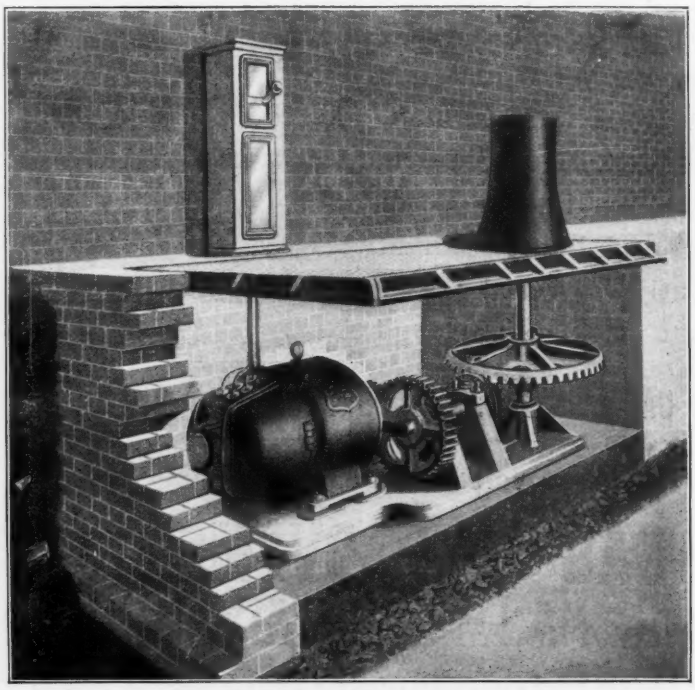

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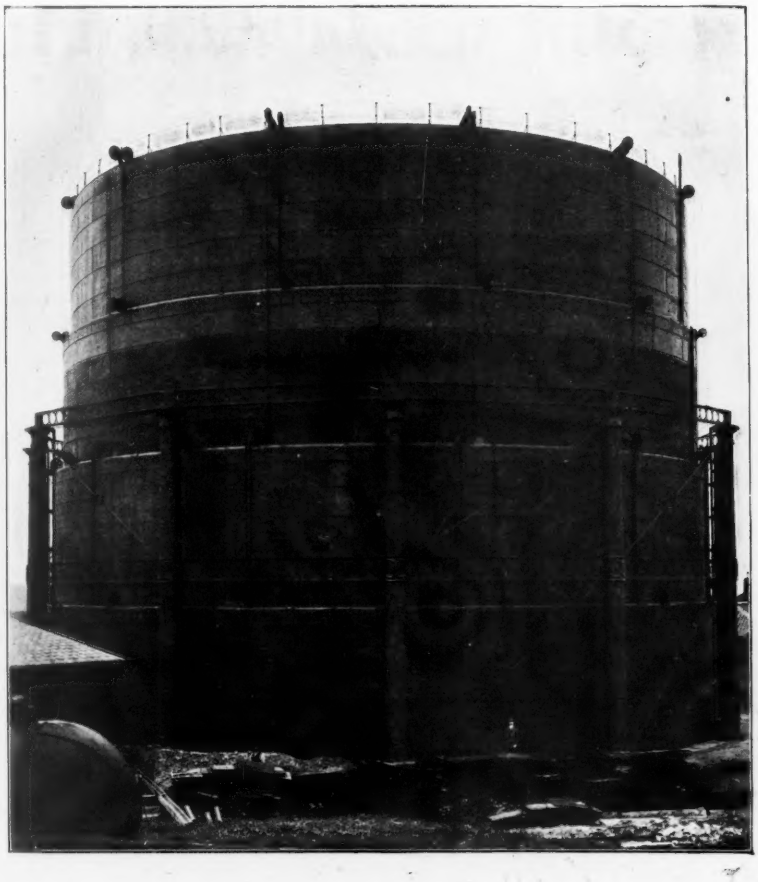

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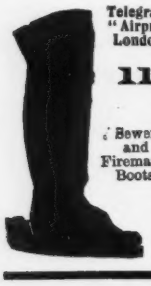

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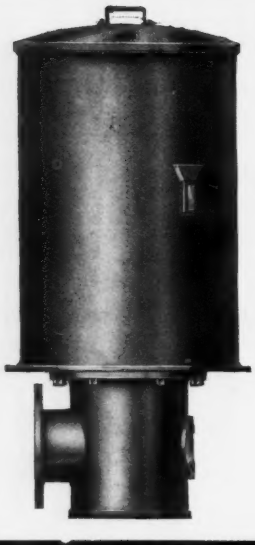

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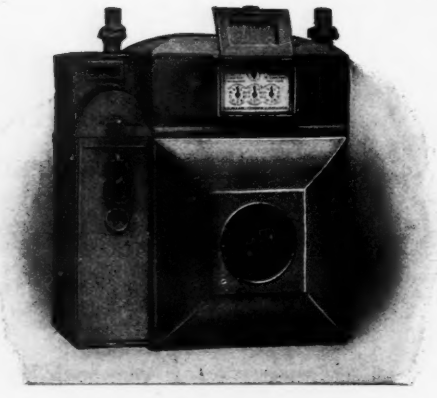
R. LAIDLAW & SON (EDINBURGH), LTD.

GAS METER MAKERS.



Thousands of our Meters in use by the largest Gas Companies and Corporations and giving

COMPLETE SATISFACTION.

Prepayment Wet Meters in Cast-Iron Cases.

Prepayment Dry Meters in Tinplate Cases.

DRAWINGS AND FULL PARTICULARS ON APPLICATION,

Simon Square Works, EDINBURGH.

6, Little Bush Lane, LONDON, E.C.

Welsbach
LIGHT
Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

Welsbach-Kern
(Patent) Inverted System

BRITISH MADE.

BRITISH MADE.

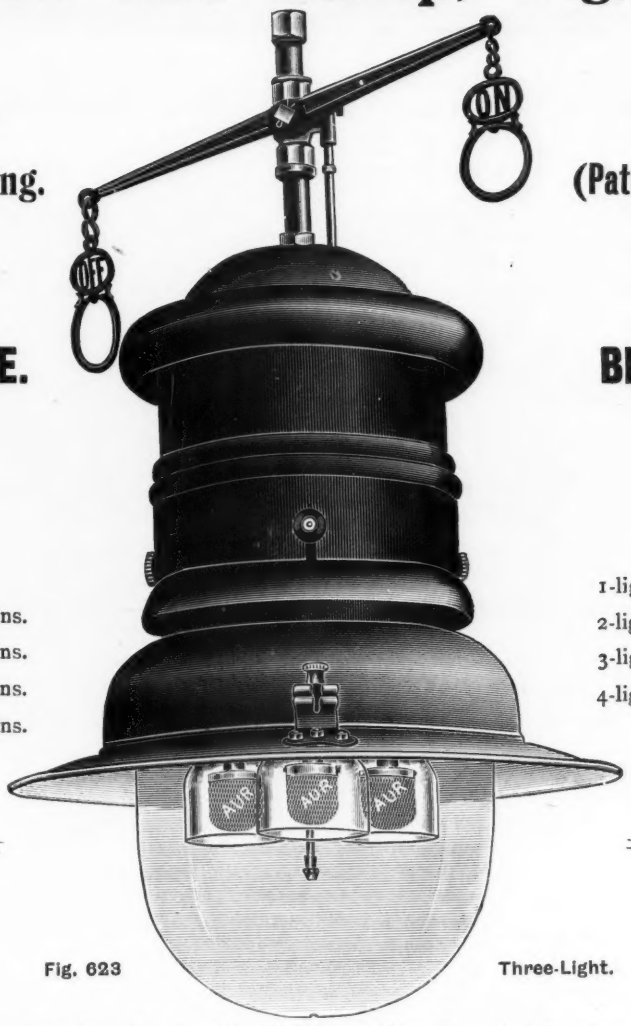


Fig. 623 Three-Light.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	*C.P.*	*Steel.*	*Copper Case.*		*Gas per hour.*	*C.P.*	*Steel.*	*Copper Case.*
1-light	4 feet	125	**30/-**	**5/-** extra.	3-light	12 feet	400	**52/6**	**6/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.	4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

		1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each		**2/3**	**5/9**	**5/9**	**9/-**
„ „ „	In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**
Case contains . .		*80*	*18*	*18*	*12*

		1-Light.	*2-Light.*	*3-Light.*	*4-Light*
Wired Globes, extra	each	**2/-**	**2/-**	**2/9**	**3/6**
Parabolic Reflector, extra	„	**3/6**	**6/-**	**7/6**	Not made

Welsbach Mantles, each **6d.** subject as usual.

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

THE WELSBACH INCANDESCENT GAS LIGHT CO., LTD.,
Welsbach House, 344-354, Gray's Inn Road, London, W.C.
Telegrams and Cables: "WELSBACH LONDON." *Telephone 2410 NORTH.*

THE WIGAN COAL & IRON CO., LIMTD.,

Are the exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, Wigan, and of the Manton Steam and House Coal Collieries, Worksop, Notts, and supply the well-known Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, House and Steam Coals, &c.

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INCLINES AT 45 DEGREES.

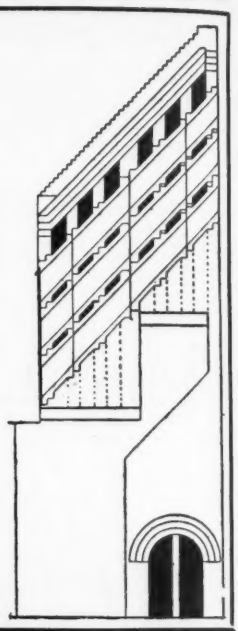
CARBONIZATION MADE EASY.

A Few Recommendations for this System:—

Simplicity of Design.
No **Machinery** to get out of order.
Carbonizing charges **40 per cent. less** than with Horizontals.
No skilled Stokers necessary.
Yield of Gas per ton guaranteed about 1000 cubic feet more than under present conditions, of guaranteed candle power.

Heats under absolute control throughout the whole length of the Retorts.
Saleable value of Coke greatly increased.
25 per cent. greater yield of Ammonia.
More liquid Tar.
Stopped Pipes unknown.

Naphthalene always in solution.
45 per cent. less ground space required.
Constructional cost per Ton carbonized considerably less than with Horizontal or Ordinary Inclined Retorts.
Several Installations in course of construction or completed.



FULLEST ENQUIRIES INVITED.

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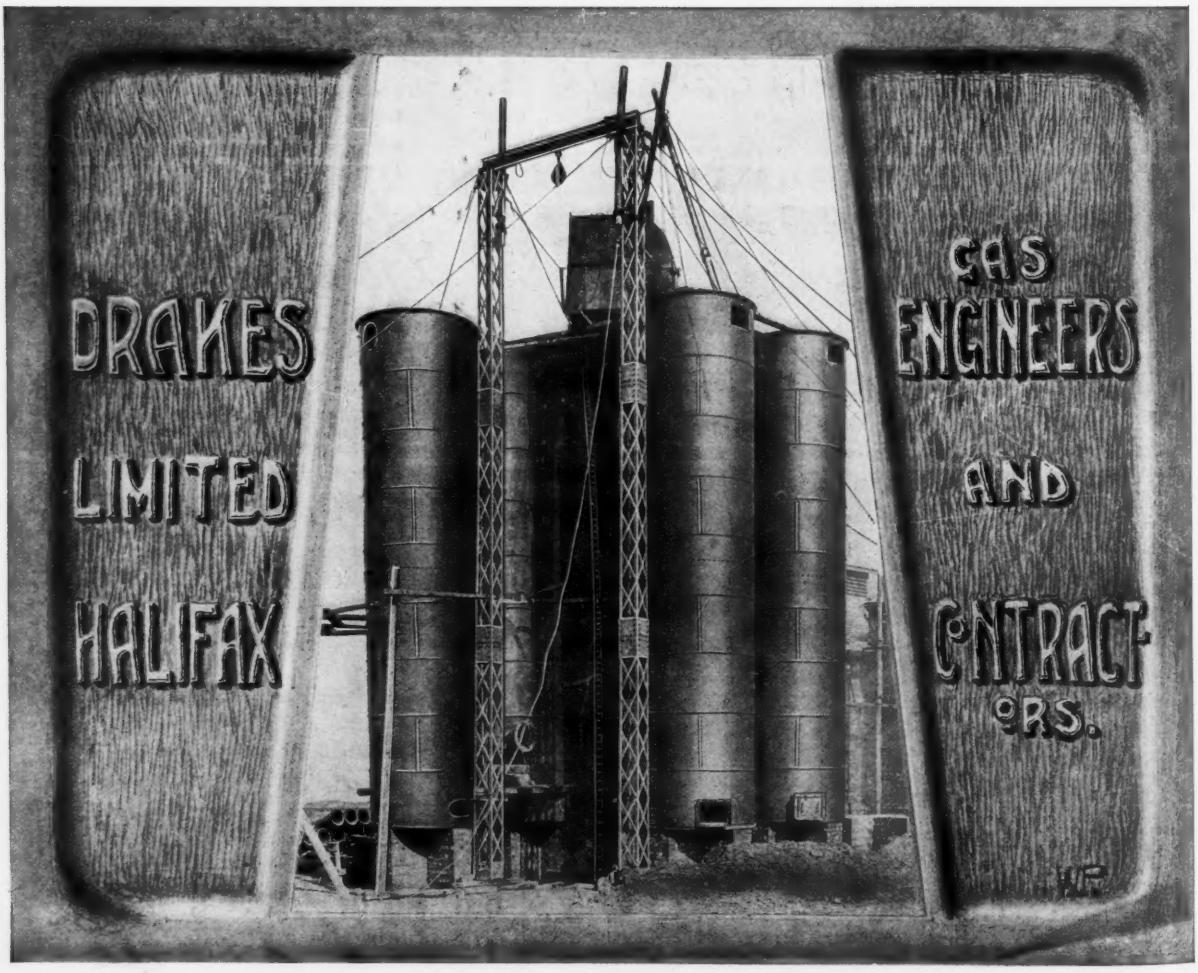

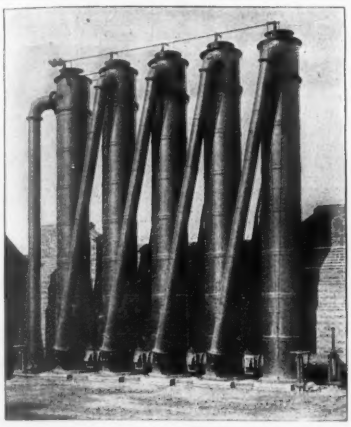

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WITH GUIDE FRAMING OR COLUMNLESS.

LUTED PURIFIERS LUTELESS

WATER **Condensers** AIR

GAS PLANT OF EVERY DESCRIPTION
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CARBURETTED WATER-GAS PLANT.

MAXIMUM EFFICIENCY GUARANTEED.

Inspection of Working Plants Invited.

No. 227.

THE "DARWEN" ARCH PIPE

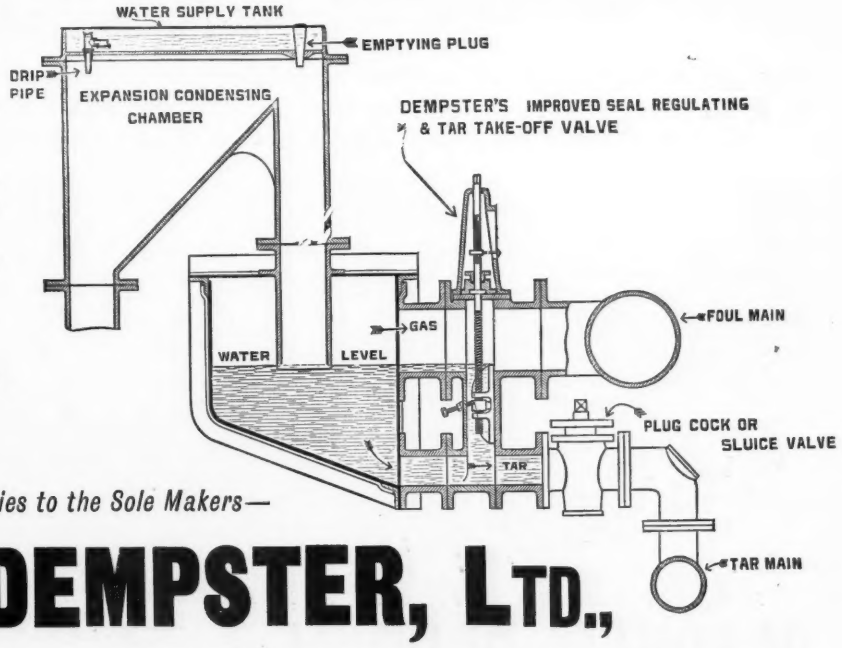
Prevents Stopped Ascension Pipes.

"The Cost is moderate and can be saved in a Single Season."

"The Arch Pipes can be seen in operation upon application."

"It will pay you to try them upon troublesome Pipes."

Upwards of 400 are already at Work or on Order.



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GAS PLANT WORKS, **MANCHESTER.**

KEITH BLACKMAN

Keith Blackman Gas Blower or Exhauster.

GAS BLOWER AND EXHAUSTERS

FOR BOOSTING GAS MAINS.

Made in various sizes, and also supplied fitted with direct coupled Electric Motors and Steam Turbines.

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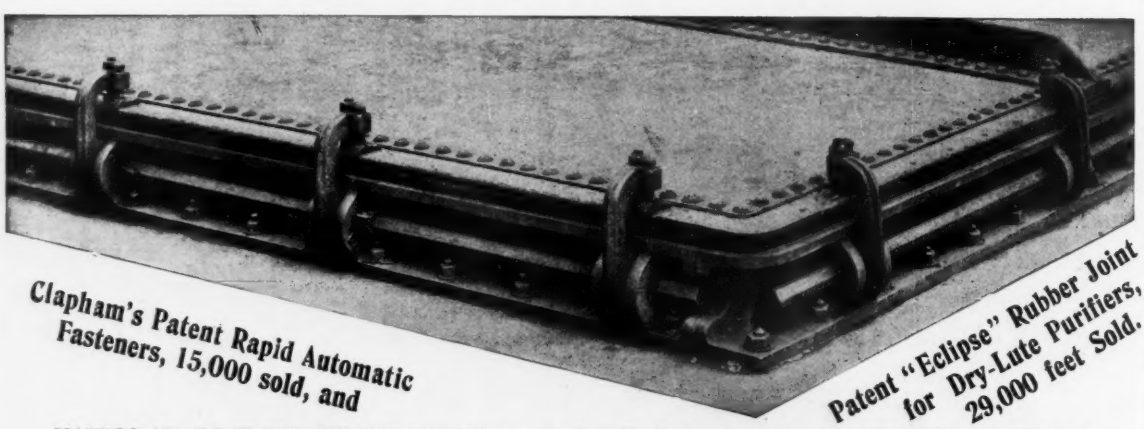

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